SCIENTIFIC AMERICAN

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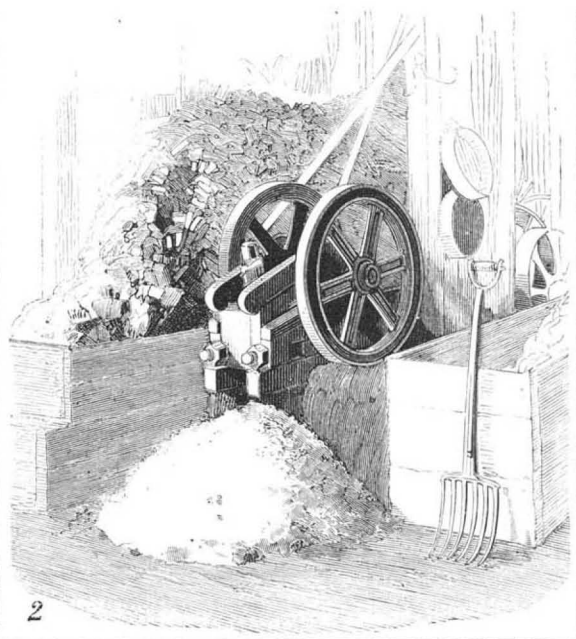
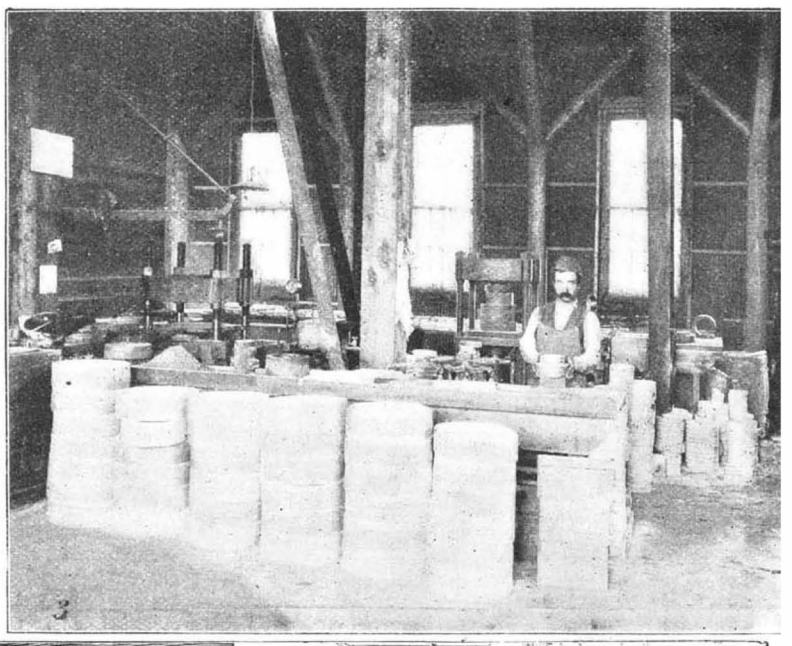
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

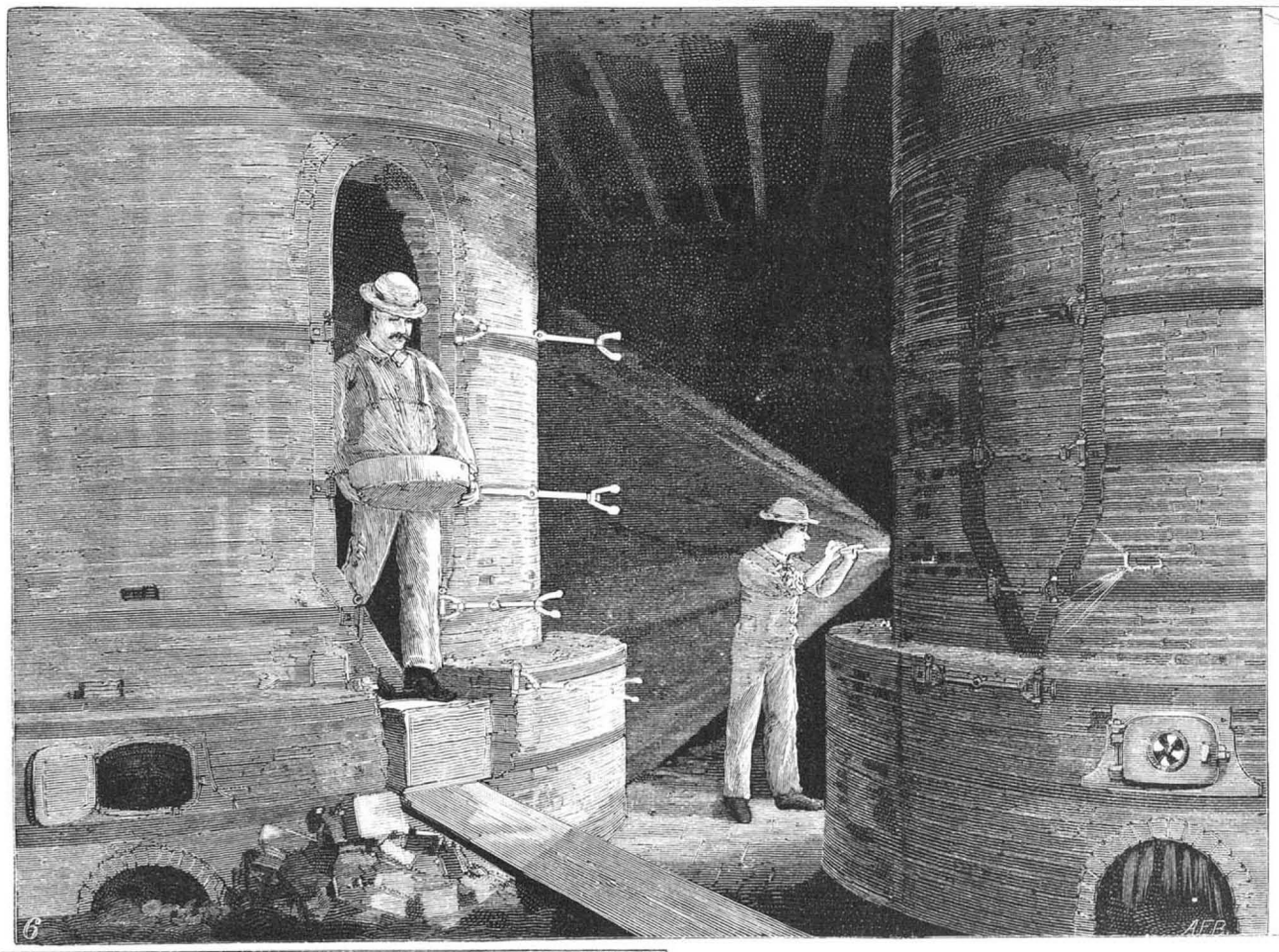
Vol. LXX.—No. 14.
ESTABLISHED 1845

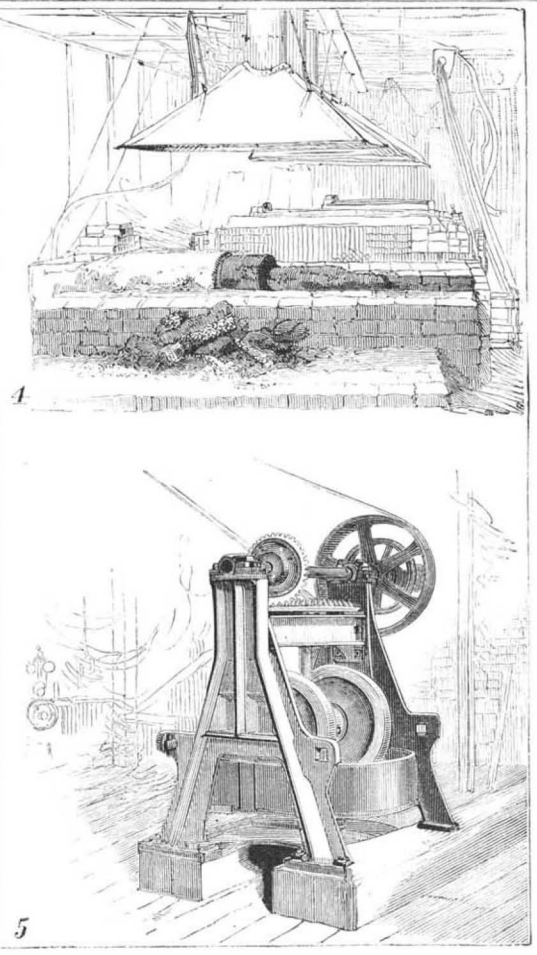
NEW YORK, APRIL 7, 1894.

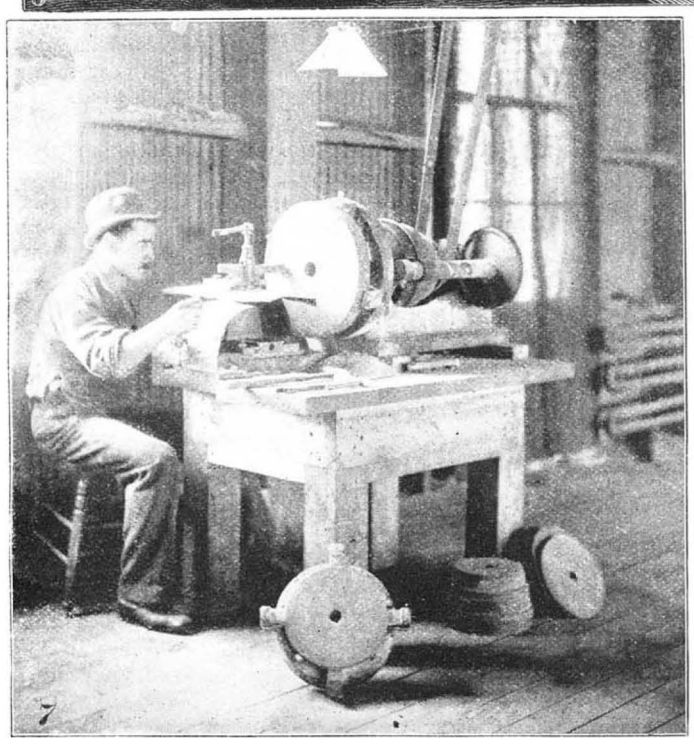
$3.00 A YEAR.
WEEKLY.

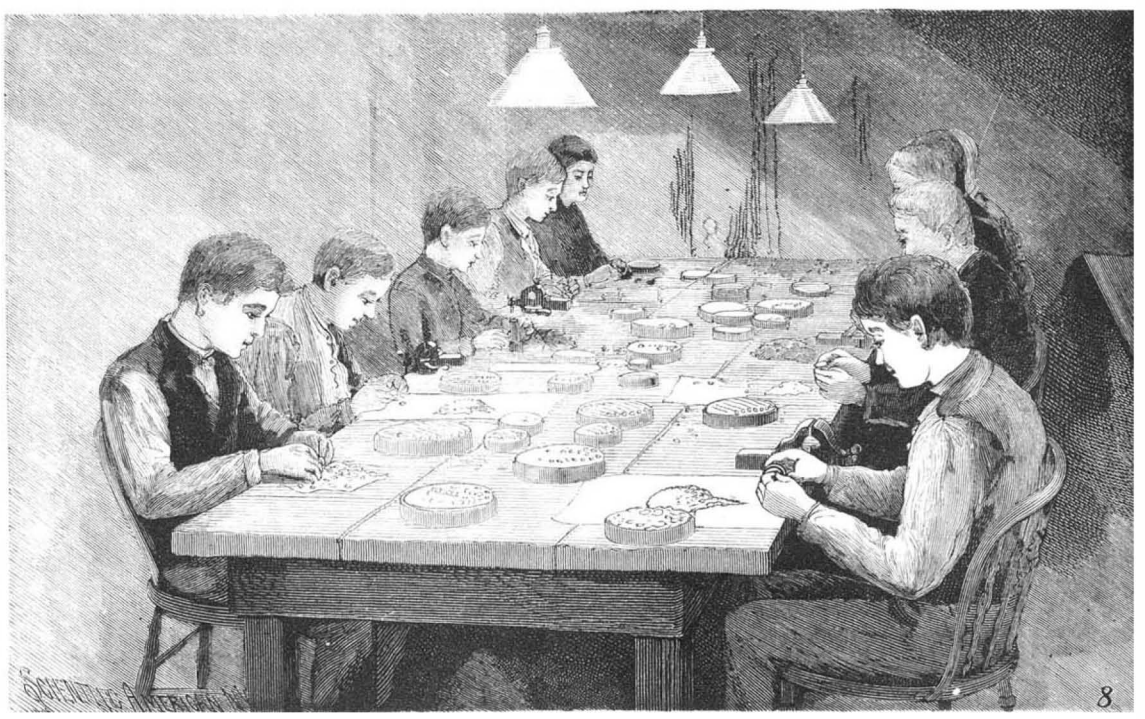












1. E. G. Acheson, inventor of carborundum. 2. Crushing coke. 3. Filling moulds, and pressing. 4. Carborundum furnace. 5. Mill. 6. The kilns. 7. Truing the wheels. 8. Moulding small carborundum wheels.

THE MANUFACTURE OF CARBORUNDUM—A NEW INDUSTRY.—[See page 215.]

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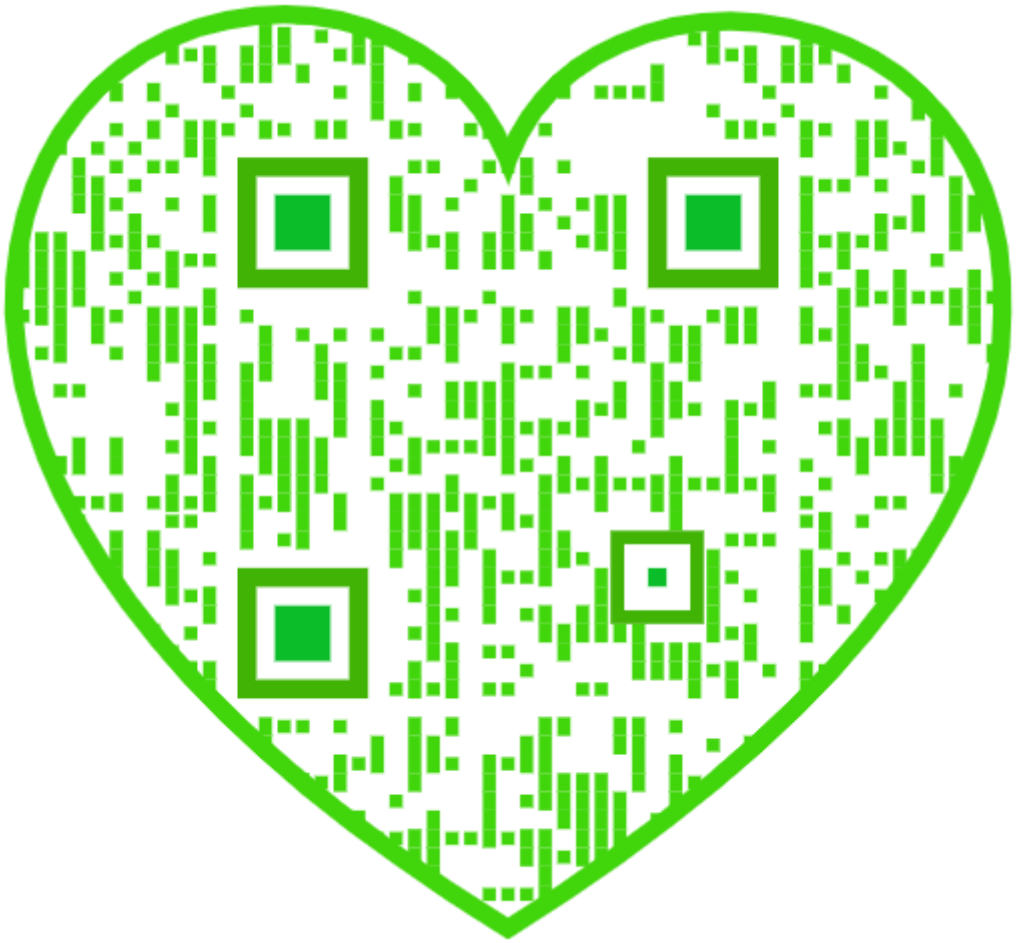

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

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361 Broadway, New York.

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NEW YORK, SATURDAY, APRIL 7, 1894.

Contents.

(Illustrated articles are marked with an asterisk.)

Abrading material, a new*..... 215
Agricultural inventions, recent. 220
Algol, the system of..... 216
Birth, quadruple..... 212
Boiler, Serpollet's steam*..... 213
Books and publications, new.... 220
Brace, Reid's, "lightning"*.... 213
Bunsen burner, Friedburg's*.... 213
Cable power station, Baltimore* 212
Camels, Arizona..... 218
Carborundum manufacture*.209, 215
Cellars, waterproof..... 216
Cholera, mercurial soap for..... 211
Coal, American, in Mexico..... 218
Diamonds, African 217
Dollar mark—its origin..... 214
Electricity from belts (5937)..... 221
Ferro-manganese exports..... 214
Fish, deep sea..... 212
Fishing, a new system of..... 215
Foundations, repairing..... 217
Garbage, utilization of..... 211
Gas burner, Williamson and Buzby's*..... 212
Glaciers, artificial..... 214
Hairy people of Ainu, Japan..... 218
Ice rink, the..... 216
Inventions recently patented... 220
Journal box supports, Hey's*.... 214
Limestone made into marble.... 214
Longevity, aids to..... 219
Navies of Europe..... 219
Notes and queries..... 221
Patent Commissioner's report, 1893..... 210
Patents granted, weekly record. 221
Patent suit, an important..... 216
Photographer, the first 218
Pipe cutters, decision on..... 217
Pipe tongs, substitute for*..... 216
Prevention better than cure..... 210
Projectiles, 12-inch, testing..... 211
Scurvy, lime juice for..... 212
Shoes, lace..... 212
Stamp mill, a steam*..... 216
Steam, long-distance use of..... 214
Street maintenance..... 215
Street railroads, Baltimore*..... 212
Sugar, beet..... 211
Tanning, chemistry in..... 218
Telephone, steering by..... 211
Tobacco, smoking, manufacture of*..... 219
Tramcars, steam, Serpollet's boiler*..... 213
Windmill, a high*..... 217
Wool dyeing..... 218
Wrench, Seymour's*..... 212

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 953.

For the Week Ending April 7, 1894.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ASTRONOMY.—The Planet Venus.—A popular and interesting article on the different aspects of the planet —4 illustrations..... 15236

II. BACTERIOLOGY.—Action of Light on Bacteria.—By Prof. H. M. WARD.—Results obtained by exposing bacterial cultures through the spectrum.—Possibility of disinfecting action of the arc lamp.—1 illustration..... 15238

III. CHEMISTRY.—Chemical Properties of Gases.—By FRANCIS C. PHILLIPS.—Continuation of this valuable paper on the origin of natural gases and petroleum especially..... 15234
Hot Water Funnel.—Simple laboratory appliances for hot filtration.—1 illustration..... 15229

IV. ELECTRICITY.—Electrically-propelled Vehicles for Ordinary Roads.—Electrical vehicles now being exhibited in London.—1 illustration..... 15230
Speed of Propagation of an Electrical Disturbance.—A simple method of determining the speed of electric transmission..... 15230

V. ENTOMOLOGY.—The Acari.—A minute parasite and its curious habits..... 15238

VI. MECHANICAL ENGINEERING.—The Automatic Balance of Reciprocating Machinery and the Prevention of Vibration.—By W. WORBY BEAUMONT.—A valuable paper on the subject of increasing importance in the use of high speed machinery.—14 illustrations..... 15226
Water Tube Boilers.—One of the recent developments in steam engineering discussed.—First installment of an exhaustive article on the subject.—10 illustrations..... 15224

VII. METALLURGY.—Blower for Smelting on a Large Scale.—A rotary blower of the turbine type and great capacity..... 15228
The Manufacture and Industrial Value of Aluminum Alloys.—By J. H. J. DAGGER.—A very valuable and exhaustive article on aluminum alloys, with very full tables..... 15231

VIII. MISCELLANEOUS.—Apparatus for Preventing Accidents in Factories.—Apparatus for instantly stopping the motion of machinery in cases of emergency in factories.—2 illustrations..... 15227
Riders of Many Lands.—English notes on Col. Dodge's celebrated papers..... 15229

IX. NATURAL HISTORY.—The Megaladapis.—A most interesting description of one of the typical animals of the island of Madagascar, with full illustrations.—3 illustrations..... 15236

X. PHOTOGRAPHY.—Thiocarbamid.—The use of thiocarbamid for clearing and removing stains from negatives, with formula..... 15234

XI. PHYSICS.—Flow of Solids.—Notes on Tresca's experiments..... 15228

XII. RAILROAD ENGINEERING.—Early English Locomotives.—Interesting illustrations of early English engines.—2 illustrations. 15223

XIII. SANITARY ENGINEERING.—Utilization of Town Refuse.—Disposal of garbage.—1 illustration..... 15231

XIV. SURGERY.—Locating Metallic Bodies in the Upper Air Passages.—By E. N. HEARD, M.D.—Application of the telephone to surgical diagnoses.—1 illustration..... 15231

XV. TECHNOLOGY.—Ancient Egyptian Pigments.—Pigments as used by the early Egyptians..... 15229

XVI. TOXICOLOGY.—Fish Poisons.—By J. B. NAGELVOORT.—A note on poisonous plants and their uses..... 15230

THE ANNUAL REPORT OF THE COMMISSIONER OF PATENTS FOR THE YEAR 1893.

The Annual Report for the year 1893 of the United States Commissioner of Patents has been published. It appears in the official *Gazette* of March 27, and in every way is a noteworthy document.

The ground is taken that the race retains the power of great conceptions and that the World's Columbian Exposition will make itself felt in stimulating invention. Of recent criticisms passed upon the patent system, those complaining of the inconsiderate grant of invalid patents are treated as most germane to the question of administration of the office. The Commissioner upholds throughout the report the expediency of the office granting only valid patents. A classification division for systematizing the records of the history of invention, making as far as possible the scientific and patent literature of the world accessible, is proposed. A salaried force of fifty-two employes is needed for this, some, however, giving but a part of their time to the classification work. The idea is to make the office search for novelty more thorough, and to give the office a higher standing upon the question of invention.

A study of eighty-one court patent cases, in which the patents were declared invalid, was made, and disclosed the fact that in twenty-six the references which defeated the patents were not shown to have been cited by the office, in twenty-nine a part were so cited, leaving twenty-six which were decided on office references. Again, in 988 court cases (1886—1892), 436 patents were sustained, and 532 were declared invalid in whole or in part. Of the latter, 428 were declared so by reason of some fault of the office, and 124 on new evidence. The results of a law firm's examination of fifty claims in ten patents held that thirty-five were invalid. The Commissioner cites the above and he feels that they and their like indicate the necessity for a more thorough search by the office. By classification and indexing the library and records in general the Commissioner hopes to effect an improvement in the search operations.

Recently three primary examiners resigned. The cases they had passed to issue were re-examined, and in one hundred and fifty cases the applications were withdrawn from issue, upon the ground that patents if granted for them would be void. This fact also is cited in the report to emphasize the importance of the classification of records and publications.

Various other points are spoken of. The office hereafter will make photographs of the drawings of patents in those cases where changes in the drawings are required or permitted, and will make the photographs part of the files of such cases. This is an excellent rule, as giving a full record of the original application. Precedence is to be given from the outset to actions upon the merits of applications; requirements in matters of form are to come after the other has been acted on, and after patentable matter has been found. Division of applications is only to be insisted on when an attempt is made to put several distinct inventions in one patent.

The *Gazette* now publishes the claims and principal drawings of patents which expire just before the date of the *Gazette*. This innovation, the Commissioner believes, will be a benefit to the public, partly as giving present subscribers, in a sense, the benefits of the *Gazette* of seventeen years ago.

The Patent Office exhibit at the World's Fair is alluded to. It has, as far as possible, been kept intact, and is now on exhibition in the Patent Office.

Legislation is recommended in several directions. The price of copies of patents, the Commissioner believes, could in many cases be advantageously lowered. The limitation of the term of American patents to the period fixed by the expiration of foreign patents for the same invention, the Commissioner would have changed, so that an American patent for full term could be granted if applied for within six months of the date of application in any foreign country. Legislation in the direction of establishing a patent bar is also recommended.

The business of the office for the year 1893 shows total net receipts of $1,242,871.64, against an expenditure of $845,403.36 under the appropriation, with approximately $295,635.09 additional, giving a balance in the office's favor of $101,833.19. There were 38,473 applications for patents, including 1,000 applications for designs and 120 for reissue. Twenty-three thousand six hundred and seventy patents were issued and 99 reissued. The patents issued and reissues granted during the year were less than those in 1885, 1889, 1890 respectively. Up to January 1, 1894, 521,700 patents have been granted by the United States, against 817,362 by all other countries. The year 1890 with 26,292 patents and reissues granted remains the banner year of the office.

An exhaustive report upon the scientific library of the Patent Office is included as an appendix to the Commissioner's report. This gives the history and present condition of the library, its scope and the condition of its indexing. An earnest plea is made for more money, and the need of further expenditure for its maintenance seems very clearly shown. During the year over thirty-one thousand journals and articles have been indexed. An appropriation of but $2,500 was allowed for purchase of books and periodicals and for transportation. The present effort is to make an adequate card catalogue with cross references. Within a few months it is hoped that the catalogue of about 100,000 cards will be thrown open to the public.

We cannot let the occasion pass without expressing our appreciation of the ability shown in the report. In some ways it is an innovation, the present Commissioner holding very definite views of his own upon the subject of the administration of the office, and expressing them very clearly. Much of his work is worthy of high commendation, although we cannot agree with him in all his views. The report, curiously enough, illustrates the great difficulty and virtual impossibility of the Patent Office making an adequate examination into the novelty of an invention—an examination which the Commissioner wishes to have a *sine qua non*, in the fullest degree of adequacy, for the issuance of a patent.

PREVENTION BETTER THAN CURE.

"An ounce of prevention is worth a pound of cure" is an old proverb, but one which men have been slow to apply.

The State enlarges its prisons and reformatories and asylums for the insane, instead of enforcing truant laws, preventing the opening of dens of iniquity, and forbidding the housing of human beings where disease festers and spreads with the very breeze which keeps the tenants from stifling.

But there are many signs that changes for the better have begun. The laws which science has discovered are making their appeal to the reason of more people than in any previous time and preventive measures are used where a few years ago they were unknown. It is no longer necessary that typhoid or scarlet fever, or even the lesser children's diseases, go through a well-conditioned family. The patient is now quarantined in the most remote room of the house; indeed, the best constructed houses have a room intended for temporary hospital use, with appliances which make its almost complete isolation possible. The mother is no longer considered unfeeling if she does not nurse her sick child, or the daughter unfilial if she commits the care of an invalid parent to a trained attendant. People with common sense now perceive that to sacrifice nervous energy is not the best way to show affection, and that the member of the family who is ill can be helped back to health much faster by some one who knows symptoms and how to act upon a change for the worse before the doctor arrives than by one whose only fitness for the post of nurse is relationship to the patient.

Probably not a philanthropic organization of today is doing better work than the Red Cross Society, and its work is largely preventive.

It gives courses of lectures on "First Aid to the Injured" to policemen, firemen and others. It pays the salary of nurses who are sent among the poorest people in our cities. While they care for the sick in these miserable tenement houses, they act as teachers to the well, incidentally giving lessons in cooking and the laws of health, including cleanliness, which will do more to prevent a recurrence of disease than any other means yet devised.

Now that medical science has made so great advance in the study and treatment of the eye, we may reasonably hope that the day is not far off when it will be considered just as necessary to have the little child's eyes examined to see whether they have congenital defects as it is to have him vaccinated. As a matter of fact, the chances of his ever taking smallpox are small in comparison with the chances that he has been born with astigmatism, shortsightedness or some other defect of vision, which treatment may remedy in childhood while the muscles and ligaments of the eyes are in their most elastic condition, but which, neglected, may cause most serious disorders. Experiments go far to prove that epilepsy and insanity are traceable to imperfect eyes.

The study of sanitary science as carried on at the Massachusetts School of Technology is one of the noteworthy advance movements of the day.

The ventilation of rooms, the purity of the water supplies of the State, the best methods of the filtration of water, the condition of milk, the determination of the best kinds and qualities of food for the maintenance of health, are all made subjects of investigation; the principles discovered are applied in the institution and elsewhere as people learn what service students who have had this training can give in these most vital matters.

The study made of foods by Mrs Richards, of the Institute, by Professor Atkinson and others, and the consequent opening of "New England Kitchens," where nutritious food at a low price may be had by the poor, cannot fail to help in lessening the tide of intemperance and its numberless attendant miseries.

The work of the Woman's Christian Temperance

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Union in inducing the State legislatures to introduce into the public schools instruction on the effect of alcoholic and other stimulants upon the system is probably the most telling work that organization has done—telling because preventive.

A noteworthy movement in England is about to result in the founding of an Institute of Preventive Medicine.

Such men as Sir Joseph Lister (the president), Sir Henry Roscoe, Professors Michael Foster and Victor Horsley, are members of the council who have the work in charge. The money is in their hands to begin to build and to carry on investigation in laboratories. Lectures and systematic instruction are to be given in bacteriology, and arrangements may be made for admission to the institute by those who wish to make original research there.

The day may come when we shall prefer to pay a doctor for keeping us well to curing us when we are ill.

The Utilization of Garbage.

Mr. Louis C. d'Homergue, in a communication to the *Sanitarian*, referring to a paper in the same publication by Dr. Bruno Terne, read before the Franklin Institute last June on the utilization of garbage, relates his experience and views on the subject as follows:

Having been largely engaged for fourteen years in fertilizing products, and introduced the drying of menhaden fish pumice, which has, in this country, superseded to a great extent Peruvian guano, the difficulties of drying economically large quantities of bulky articles of low values have been practically realized.

Machines which will dry or desiccate fruits or other high-priced materials are valueless in drying garbage, because, while drying a few tons of fruit daily would be profitable, that daily quantity of garbage would not pay expenses.

For example, the daily quantity of garbage of New York and Brooklyn is at least 1,000 tons, and at the estimate of Dr. Terne it would contain 15 per cent of grease to be extracted. It requires five handlings to place it in the extractors and remove it into the evaporators, and from thence to the storage sheds; then it has to be put into bags and barrels, weighed and shipped.

The usual evaporating capacity of coal in large furnaces is about one pound of coal to evaporate eight pounds of water. By scientific tests, under the best conditions, eleven pounds of water have been evaporated by one pound of coal at Woolwich. In materials containing 15 per cent of fat the best results have been, so far as I know, one pound of coal to six and a half pounds of greasy waters. The naphtha process possibly is cheaper, but very dangerous, and hence would not be allowed in cities. Hydrocarbon oils for fuel can be used at less cost than coal or naphtha. Now, if the garbage of New York and Brooklyn had to be disposed of in this way, it is apparent that the plants necessary to effect it promptly, before the mass would begin to ferment, would be of enormous capacity—otherwise the extracting or evaporating process is far more difficult.

Fifteen per cent of grease to be extracted from 1,000 tons of garbage would be equal to 150 tons daily, leaving 850 tons, from which 70 per cent would have to be evaporated to bring it down to *8 per cent* of moisture, instead of 4·41 per cent, as given in Dr. Terne's figures, because, if dried down to this, it would reabsorb up to 8 per cent moisture from the atmosphere at ordinary conditions; so it is waste of fuel to dry it down lower. This would then net 255 tons of dry material. Now, if this material at 4·40 per cent of moisture would show but 3½ per cent of ammonia, at 8 per cent of moisture it would only show a little over 1¾ per cent of ammonia, which, at $2.30 per unit of ammonia—the present quotations—would only be $4.02½ per ton. But the low percentage in phosphoric acid—potash, as given in Dr. Tere's analysis—I am afraid would not be considered merchantable; for at present the agriculturists of the country are awakening to the fact that it is not so much ammonia which the plant can absorb through their leaves (lungs) from the atmosphere that is wanted in a fertilizer as it is phosphoric acid, potash, and lime, which render the earth silicates soluble and absorbable by plants, to give strength to their stalks and life to develop their growth. So that ammonia (except in trucking) as a basis of value in a fertilizer is now being largely discounted.

On the basis of 1,000 tons per diem treated as indicated in the foregoing, the following results show that it may be done advantageously if a market could be found for the products:

Grease suitable for lubricating and rough soap about:	
150 tons at $8 per ton (grease)	$1,200
225 " " $4 " " (fertilizer)	1,020
	$2,220
I figure using oil as fuel, handling, etc	1,405
Per day	715

Certainly this is alluring enough to capitalists if a market could be found; and possibly the fertilizer would sell readily at an advanced price if so treated as to bring up its percentage of phosphoric acid and potash. It is a great question of practical sanitation as well as commercial interest, and I hope to see it practically tested.

[FROM THE LONDON PALL MALL GAZETTE.]

Steering by Telephone.

For some time Mr. Charles A. Stevenson has been making experiments for locating the position of vessels at harbor entrances, which would be of service when, during certain states of the weather, other observations cannot be easily made. He proposes that a cable might be laid down in the sea, and, by changing the electric state of the cable, vessels passing near or over it might be able, by means of a detector on board, to discover that they were in its vicinity. Some experiments showed the method to be feasible, since the sea offers no insurmountable difficulty, and he has constructed two instruments which will act through 180 feet of water.

The first instrument is a coil of uninsulated copper wire rope dipping into the water at the bow of the boat, and a similar water connection at the stern. If these are joined by a wire with a telephone on the circuit, it will be found that, even without an induction coil or other arrangement to magnify the effect, a very sensitive instrument is produced, and that, when the wires from bow to stern of the boat are at right angles or nearly so to a cable laid in the water at some distance from it, the sounds produced by a magneto-electric machine connected to one pole of the machine are audible in the telephone. If the water connections are equidistant from the cable, as they would be if the boat were immediately over the top of it, or lying broadside on, no sound is heard. The action takes place when the coils in the water are insulated. The cable also may be insulated or uninsulated. The action is similar with an induction coil, and will also act if the potential of the cable is charged and is then kept so. With the coils separated ten feet (at the bow and stern of a small boat put down from the vessel) and an insulated wire 400 feet in length, laid through a small lake of brackish water 15 feet deep, the alternations produced by the bobbins of a magneto-electric machine were perfectly distinct at the end of the lake 340 feet away from the wire, and the limit of audibility could not be ascertained. Further trials will be necessary to determine the law of the falling off of the intensity of sound with the increase of the distance from the cable for a given fixed distance between the water connections, as well as to determine the law of increase of intensity for any increase of distance between the bow and stern connections for a given fixed distance from the cable.

Mr. Stevenson's second instrument is a coil of insulated wire surrounding a core (that is, an electro-magnet with a telephone in the circuit of this coil). With this instrument the making and breaking of the current produced through a wire 200 feet in length could be detected through 60 feet of salt water. When sunk in water the sound seems just as loud. He is of opinion that the action of the instrument consists in the break, if broken sufficiently rapidly, inducing a current in the coil, which the core intensifies immensely. The sound in a Bell telephone with the instrument was almost deafening with 15 feet depth of water. This electro-magnet system of induction, in contradistinction to the parallel wire system, has no earth connection, being entirely insulated, and must, therefore, be a case of true induction through water.

Sugar Items.

On several well organized beet farms recently visited in France, cows receive 110 pounds of residuum beet pulp per diem, to which is added 44 pounds of a fermented product, consisting of chopped straw, etc. The cows under this ration yield on an average 12 quarts of milk daily. As the season advances the pulp ration is reduced.

We are informed that recent improvements in the Barbet distilling appliances permit the production of alcohol that is so pure that a permanganate solution produces no discoloration, even after one hour. A few years since, in alcohol made in stills, the chemical in question would show itself after a few minutes. The Barbet methods for alcohol analysis have become standard, and have been officially adopted by several governments of Continental Europe.

The total sugar production was less during last than in previous campaign; the causes are numerous. The area devoted to beets was about 500,000 acres. When it is considered that $4,000,000 are paid in wages at factories and several millions for farm labor, the beet sugar industry of the country has obtained a position upon which much of the general prosperity of the state depends.

The average sugar made in a French beet sugar factory is purer than sugar obtained elsewhere. It has been found, for example, that for sweetening purposes twice as much Austrian sugar is needed to produce certain results as would be required of the French product. The low price at which the rival sugars are sold is misleading the general Eastern public. In Damascus, for example, a certain paste is made, in which large quantities of beet sugar are used; for same price the manufacturer gets volume, but not quality.

During 1892 about 30,000 tons beet sugar were employed in strengthening wines and cider by fermentation. It is interesting to note that the quantity of sugar used for this special purpose was less than during the previous year—due to the fact that the grapes were of a better quality than during 1891.

An interesting method for the manufacture of levulose with beet molasses has met with some success (?) The saccharose is first transformed into dextrose and levulose. If lime be added, there will be formed a precipitate of levulosate of lime, almost pure, while the coloring and other substances remain in the solution. By a careful filtration and carbonatation it is possible to obtain pure levulose. About 100 pounds molasses are dissolved in 6 pounds water, and the amount of acid used depends upon the alkalinity of the residuum being treated.

A new process for the purification of beet juices with an iron chloride is said to offer satisfactory results. It is claimed that the purification is more complete than possible to obtain with lime and the regular method of carbonatation. The chloride used precipitates the albumen, and other organic substances are also precipitated at same time. Raw juices from the battery are mixed with lime until their alkalinity is about 0·08 per cent. and to 30 gallons of juice is added one quart of iron chloride. Lime is then mixed in and the liquor heated to 176° Fah. Second carbonatation follows, and to 25 gallons of juice ½ pint chloride is added. The saturation that follows should bring the alkalinity down to 0·05; and when this purification is properly done, there remains no trace of iron.—*The Sugar Beet.*

Testing Twelve-Inch Shot.

A very successful trial of 12-inch shot took place at the Sandy Hook proving ground, March 29. The expenses incurred by the government and the manufacturers amounted to over $17,000, the armor plate alone, which was used as a target, costing $12,600. The trial of the 12-inch armor-piercing projectiles was made with the 12-inch guns supplied by the Watervliet Arsenal, while the projectiles were made by the Midvale Steel Company, of Philadelphia, and the Carpenter Steel Company, of Nicetown, Pa. The new shot are three and one-half feet long and weigh about 1,000 pounds. The heads of the shot are hardened by a secret process. The target was an oil-tempered, annealed, nickel-steel plate made by the Bethlehem Iron Company. The plate was 13½ inches thick, the length was 16 feet, the width 9 feet and the weight was 35 tons. In all four shots were fired, and a number of spectators were present in spite of the cold rain storm. The plate was set up 150 yards from the gun and the charge used was 355 pounds of brown prismatic powder; the chamber pressure was 23,000 pounds. All of the projectiles pierced the plate, which was cracked in all directions. The first (Carpenter) shot when dug out of the sand bank was found to be broken, the other shots were not broken. The heat generated by the force of impact on the plate was about 600° Fah. The behavior of the projectiles was regarded as highly satisfactory. The government has contracts for about 250 of the 12-inch shot.

Mercurial Soap for Cholera.

According to the *American Architect*, two chemists of Hamburg, MM. Forster and Nijland, have published some studies on the cholera infection, from which it appears that soap is one of the best known sterilizers of water suspected of infection. For a long time after the cholera epidemic of last summer, the people of Hamburg were afraid even to bathe themselves with Elbe water, but MM. Forster and Nijland show that ordinary toilet soap, added at the rate of an ounce to about twelve quarts of water, will kill the cholera bacilli in ten minutes. This would be a large proportion of soap to use in a bath, but as most people, instead of dissolving soap in the bath water, apply it to the skin with a sponge, it is probable that the water actually brought in contact with the skin is generally soapy enough to be harmless. If, however, it is desired to obtain greater security, a soap containing a small quantity of corrosive sublimate may be used. Many "complexion washes" contain this drug, which is said to have a beneficial effect on the skin, however dangerous it may be internally, so that no hesitation need be felt in employing soaps medicated with it, and a very small quantity is sufficient. With a soap containing one per cent of corrosive sublimate, added at the rate of a quarter of an ounce of soap to sixty quarts of water, all the cholera bacilli will be killed in one minute, and half the dose will kill them all in ten minutes; while the sublimate alone is still more active, an ounce being sufficient to destroy, in five minutes, all the cholera microbes in about a million quarts of water.

THE strongest timber known is the "Bilian" or Borneo ironwood, whose breaking strain is 1·52 times greater than that of English oak. By long exposure it becomes of ebony blackness and immensely hard.

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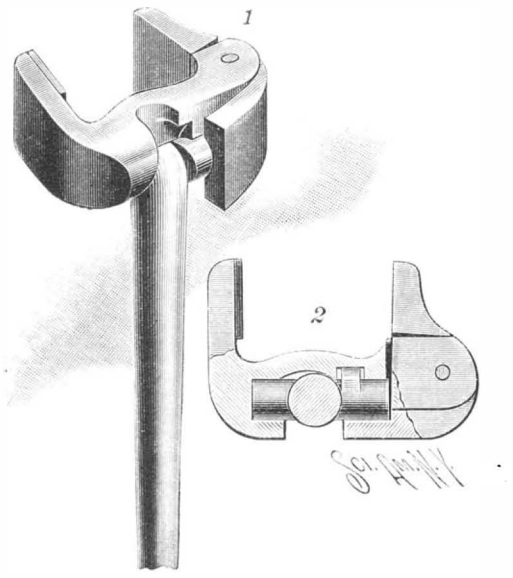
AN IMPROVED WRENCH.

This wrench, shown in perspective in Fig. 1 and in section in Fig. 2, has been patented by Mr. Frederick S. Seymour, of Lake Geneva, Wis. (P. O. box 161), the invention being an improvement on a former patented invention of the same inventor. The wrench has a fixed and a movable jaw, the fixed jaw having on its inner clamping surface a pad of leather or similar material, and the other extremity of this member having upper and lower knuckles forming a recess in which is pivoted the movable jaw. The back member of the



SEYMOUR'S WRENCH.

fixed jaw has also at one side a socket and at its other side a recess adapted to receive the T-head of the wrench handle, one branch of the head having on one face a cam, and the rear member of the movable jaw preventing the head from disengaging with the body of the wrench. When the head of the handle is in normal position, the cam will be opposite a recess in the body of the wrench, and the jaws will be parallel, as shown in Fig. 2, but when the handle is turned to the position shown in Fig. 1, the cam engages the rear member of the pivoted jaw, and the jaws are thus carried to positive engagement with the nut or other article to be clamped.

Lime Juice for Scurvy.

Probably few persons outside the industries actually concerned are aware that under the provisions of the British lime juice act the Board of Trade are empowered to compel the ships' captains to serve out to their crew a fluid ounce of lime juice per day, and to hold the masters responsible for the actual swallowing of the dose by the men. Any case of recalcitrancy on the part of one of the crew has to be entered into the official log book, and in case these precautions are neglected the master is liable to a heavy penalty. Thanks to the provisions of the act, scurvy has been almost stamped out.

Deep Sea Fish.

Dr. Hickson, in his new book, "The Fauna of the Deep Sea," points out in a very vivid manner an extraordinary danger to which the deep sea fish are liable. At the great depths at which they live the pressure is enormous—about two and a half tons on the square inch at a depth of two thousand five hundred fathoms. It sometimes happens that in the excitement of chasing a prospective meal the unwary fish rises too high above his usual sphere of life, when the gases in the swimming bladder expand, and he is driven by his increasing buoyancy rapidly to the surface. If he has not gone too far when consciousness of his danger grows greater than his eagerness for prey, the muscles of the body may be able to counteract this, but above this limit he will continue to float upward, the swimming bladder getting more and more inflated as the unfortunate creature rises. Death by internal rupture results during this upward fall, and thus it happens that deep sea fish are at times found dead and floating on the surface of the ocean, having *tumbled up* from the abyss.

THE BALTIMORE TRACTION COMPANY.

Of the seventy-five miles of track now included in the system of this company, thirty-five miles are operated by electricity, fifteen miles by cable, and twenty-five miles by horses.

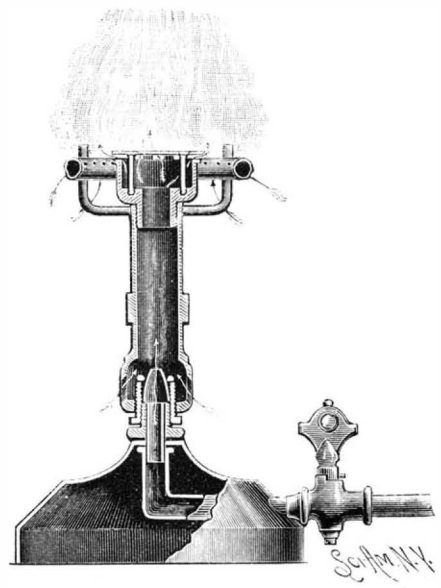
The Druid Hill Avenue cable line, which has been in operation since May 23, 1891, was virtually the beginning of rapid transit in Baltimore. The Gilmor Street cable line, which runs west from the center of the city and then north to Druid Hill Park, is built upon the same general plan as the first line, with some changes in the driving machinery. The strictly unique feature of the Gilmor Street line is its power house, the Epworth power station, as it is called from the fact that the machinery is installed in what was formerly the Epworth Methodist Church, at the corner of Gilmor and Mosher Streets. Francis H. Hambleton is the chief engineer of the Traction Company.

The engine room is 79×58 feet, the tension room is 51×72 feet, the boiler room is 41×104 feet, and the coal room is 41×47 feet. The machinery consists of two plain Corliss engines, 36×60 inches, built by the Corliss Steam Engine Company, of Providence, R. I., and driving gear for two ropes, built by the Robert Poole & Son Company.

The two cables, 10,000 and 22,000 feet in length, are driven at the same speed—eleven and a half miles—but each has its independent driving gear. A rope drive of twelve ropes is used, the driving pulleys being ten feet in diameter and the driven wheels twenty-four feet. In this rope drive Mr. Hambleton has introduced a device for equalizing the strain on the cables. Instead of driving the two twenty-four foot pulleys of each set of gears from a single ten foot pulley on the main engine shaft, the driving pulley is split and provided with a compensating gear on the order of the Whitton gear for cable drums. With this compensating gear on the rope drive, and the Walker differential cable drums, a complete equalization of the power is assured. The cable drums are thirteen feet six inches in diameter. The tension device, which was designed by the engineers of the company and the builders, the Robert Poole & Son Company, consists of the usual traveling carriage and weights rising and falling in a fifteen foot pit. The tail rope of the carriage passes over a fixed sheave at the extreme end of the run, through a sheave on the weight, and up again to a geared drum, by which any abnormal variations in the tension or length of the cable can be met. By this arrangement the entire length of the run is utilized and the somewhat limited space is used to the best advantage. This plant has capacity in excess of its present requirements, but it was designed with a view to future needs and possible extensions of the line. We are indebted to the *Street Railway Journal* for our engraving and the foregoing particulars.

A HEATING GAS BURNER.

This is a burner of the Bunsen type, but just outside of and surrounding the flame is held a metal tube

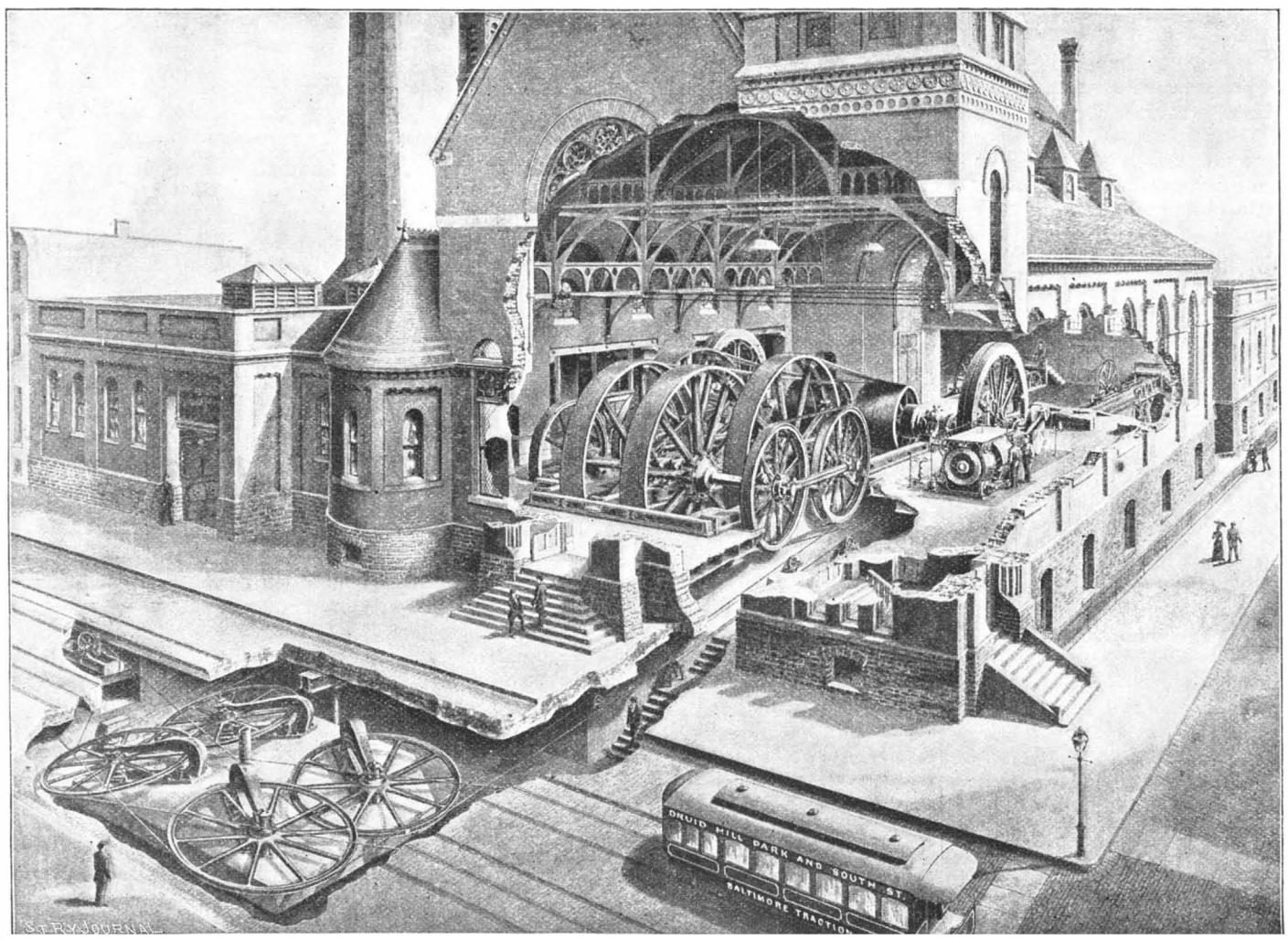


WILLIAMSON & BUZBY'S HEATING GAS BURNER.

with air-receiving openings on its under surface, and air-discharging apertures in its upper portion, impinged by the flame, thus effecting more perfect combustion and producing an intense heat. The improvement has been patented by Messrs. John R. Williams and Isaac W. Buzby, of Seattle, Washington. On the gas supply tube, fitted in a suitable base, is a conical nozzle, surrounded by the chambered lower end of a mixing tube, near the bottom of which are air apertures, while in its upper end is inserted the threaded portion of the burner. The latter consists of a casting, with lateral apertures through which the gas issues, and with lugs at short intervals, the top of the casting being closed by a disk which rests upon the lugs and is secured in place by screws. The surrounding air supply tube is supported by right-angled rods, and is preferably of oval section, although it may be circular or triangular in section, and its lower air-receiving openings are larger than the discharge apertures. The flame, impinging upon this hollow ring or tube, raises it to a high temperature, and correspondingly heats the air discharged therefrom to mingle with the gas of the flame.

Quadruple Birth.

A recent number of *La Ilustracion de Cuba* states that on the 27th of February last, Madam Buenviaje Carillo, wife of District Attorney Don Luciano Jimenez, of Remedios, gave birth to four robust children. All doing well at last accounts; the little ones soon to be baptized.



GILMOR STREET CABLE POWER STATION—BALTIMORE TRACTION COMPANY.

SHOES are now made of lace—the thick guipure description. They are very dainty and yet strong. Good leather shoes and boots are to be had ventilated in such a manner as not to expose the foot to wet or damp. This is an excellent move, as thick leather is apt to heat the foot unduly, causing great discomfort to the wearer.

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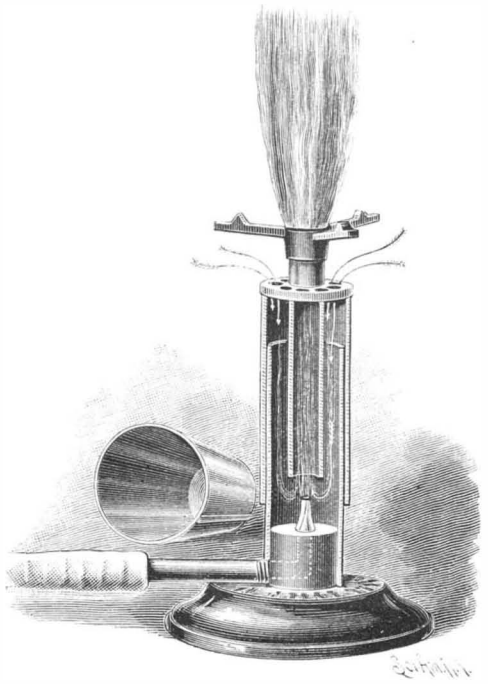
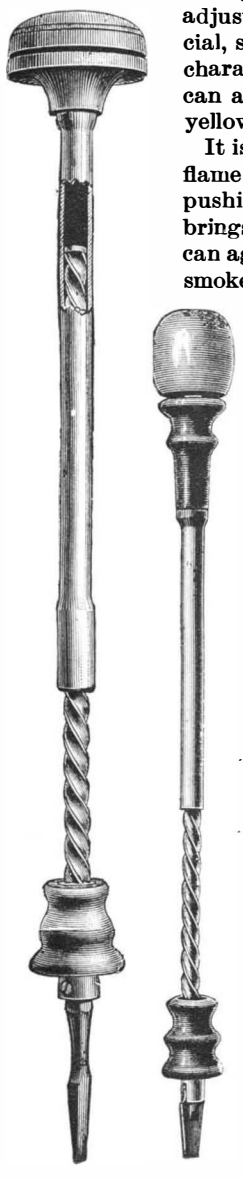
FRIEDBURG'S BUNSEN BURNER.

The Bunsen burner illustrated in the cut is the invention of Prof. L. H. Friedburg, of this city, and is designed for chemical laboratories. It disposes of the troubles incident to the ordinary type of construction, such as the jumping down of the flame and smokiness at the tip. It consists of a base with the usual nipple for attachment of the rubber supply tube, and with a tube terminating in a gas orifice in the center of the base. This orifice is of approximately rectangular or slot-like form, one easy to clean and which has proved adapted to secure the mixture of air and gas. The base supports a brass tube, about an inch in internal diameter, which surrounds the gas jet like a chimney. A second brass tube telescopes over this one. The top of the telescoping tube is covered with a diaphragm. A circle of holes are drilled in the diaphragm near its periphery, through which the air for mixing with the gas enters. The combustion tube passes through the center of the diaphragm.



FRIEDBURG'S BUNSEN BURNER.

In operation the gas is turned on, and entering by the central jet, rises into the central combustion tube, and as it does so draws in air which mixes with it. It is lighted at the top of the combustion tube. A very perfect flame results—showing not the least particle of yellow, provided the telescoping tube is rightly set. It is here that one of its best features appears. By raising the telescoping tube more air is admitted to mix with the flame, and by lowering it the supply can be cut off almost completely. Thus the burner can be adjusted for any gas, natural or artificial, so as to give a proper flame. The character of the flame for a given gas can also be made to vary from a full yellow to a blue superoxidized one.



It is almost impossible to make the flame jump down, but if it should, the pushing down of the telescoping tube brings the flame back, when the tube can again be raised to give the desired smokeless flame. The burner will work in any position. It is proposed to mount some on universal joints, so that they can be inclined in any desired direction. The burner may fairly be said to represent an important advance in laboratory appliances.

REID'S "LIGHTNING" BRACE.

This improved brace is especially designed for light boring and screw driving. It is very quick in its work, and as the power is applied on the top, it may be used with great force. It may be used automatically, running the bit both back and forward, or to turn the bit one way only, as is necessary to drive a screw or bore a hole with an auger bit. This is done by means of the divided head, which acts as a fast and loose pulley, there being no ratchet about it to get out of order. It is made strong and durable, the metal part finely polished and nickel plated, and the trimmings of lignum vitæ and rosewood. This brace is manufactured by A. H. Reid, No. 3000 Market Street, Philadelphia, Pa.

STEAM TRAMCARS WITH SERPOLLET'S BOILER.

Mr. Serpollet's generators for the instantaneous production of steam, to which we have several times called the attention of our readers, have, up to the present, been limited to a power of from five to six horses, in consequence of the spiral form given the tubes constituting the element of the boiler. In order to reach a power of from 15 to 20 or more horses, it was necessary to multiply the elements and to substitute for them straight bars grouped quincunxially and mounted in tension, with tubes supporting the high pressures without strain or distortion. This result is now obtained by the use of U tubes that permit of effecting a saving in the weight of the apparatus, of increasing their specific power of vaporization and of thus applying them to locomotion with certain advantages that we shall set forth in taking as an example the application that has just been made of them in the propulsion of tramway cars upon one of the best patronized Parisian lines. The vehicle that is now running in Paris, from the Madeleine to Clichy Place, is an ordinary type of the car of the Tramway Company of Paris and of the Department of the Seine.

The system, as a whole, adapted to the car, in order to render it automobile, motors, generator, accessories, water and fuel, weighs about 1,500 kilogrammes, the car weighing 3,500. The car, empty, in running order, therefore, weighs five tons. With forty passengers of 70 kilogrammes each, the total weight reaches 7,800 kilogrammes.

When the automobile car hauls another weighing, when empty, 3,200 kilogrammes and carrying thirty-two passengers, which represents 5,440 kilogrammes, we reach a total weight of 13,240 kilogrammes.

It is this heavy load that the motive system combined by Mr. Serpollet permits of hauling, with a mechanical part whose weight scarcely exceeds a tenth of the total weight.

The steam generator and the driving apparatus are installed in the front of the car (Fig. 3). These apparatus, few in number, comprise a starting pump, a regulator of speed through a return of feed water to the tank, and a reversing lever.

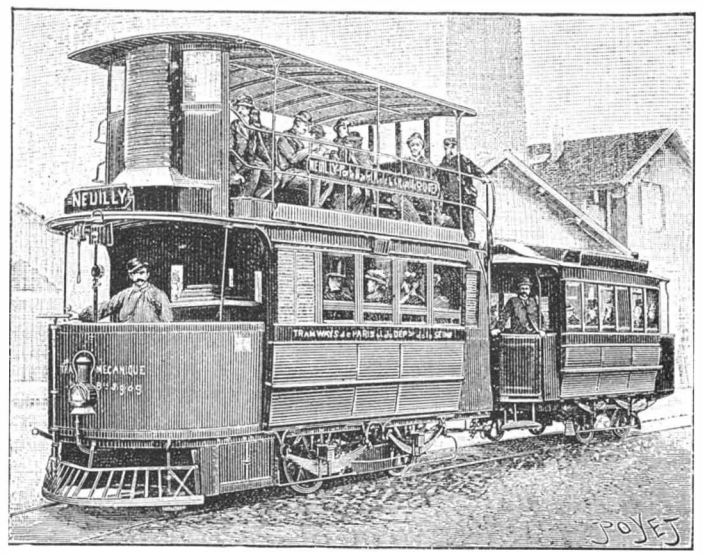


Fig. 3.—GENERAL VIEW OF A SERPOLLET TRAMCAR HAULING ANOTHER CAR.

The motor is fixed beneath the platform, with its axis in the same plane as that of the axles. It consists of two steam cylinders of 13 centimeters internal diameter and 13 centimeters stroke, arranged at each extremity of the car and acting upon the axis through two cranks keyed at right angles.

The entire mechanism is hermetically inclosed in two iron plate boxes, in which are disengaged the vapors of the lubricating oils eventually produced in the running at a high temperature. These two boxes debouch in the ash box through a wide conduit, and it is through the latter that the air enters that supplies the firebox (Figs. 1 and 2). The vapors of oil carried along by the air are consumed on the grate before reaching the chimney. The noise that might be produced by the exhaust is suppressed by the use of a deadening reservoir interposed between the chimney and the exhaust. The cloud of steam is suppressed by the very fact of the use of superheated steam as soon as the system of tubing has reached the normal temperature. The cloud of smoke likewise is suppressed through the use of coke as fuel.

The boiler consists of eighteen elements, each comprising two straight tubes connected by an elbow. These tubes, which are 45 centimeters in length, have the form of an inverted U, and are 12 millimeters in thickness. These eighteen elements, connected in series, are arranged horizontally, and so distributed as to break the ascending column of hot gases. A gutter shape has been adopted in order to increase the rigidity and permit of reaching high pressures without distortion. Instead of working by flexion, the sides work one by traction and the other by compression.

The injection of cold water is effected through the lower part, while the steam at 250 or 300 degrees escapes from the last element in order to reach the valve box. The tubes being arranged at the lower part of the boiler, nearest the firebox, thus always preserve a relatively low temperature, and run no risk of being burned.

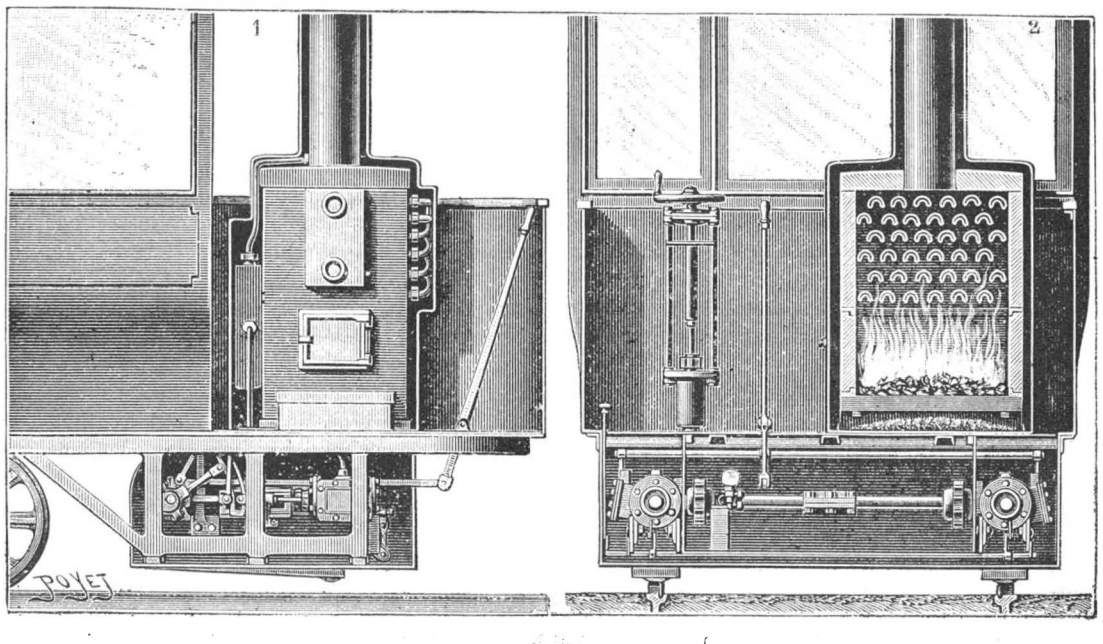
Such a boiler weighs only 600 kilogrammes. With a total external surface of tubes of 4 square meters and a grate surface of 26 square decimeters, it produces sufficient steam to develop a power of 20 horses at a pressure of 5 kilogrammes per square centimeter—a power that may reach that of 40 to 50 horses on allowing the pressure to reach from 10 to 15 kilogrammes per square centimeter.

A boiler is heated with coke, which is packed in small boxes each containing a supply sufficient for a run of from 10 to 12 kilometers, and that are put in at the terminus. The quantity of water carried is likewise renewed at the terminus at the rate of about 12 liters per kilometer traversed. The consumption of coke is about 1·7 kilogrammes per kilometer on a level for the automobile car alone.

Incrustation of the boiler can never occur, for every time that the production of steam is arrested, either for the stoppage of the car or descending a declivity, the generator is emptied by a return to the tank. The steam contained in the valve boxes, tubing and generator takes a direction backward in sweeping the sides of the tubes with great force; so, in this sort of application, no other preventive measure is taken against incrustation than that resulting from the very operation of the system.

The order of the products of combustion is itself annulled through an ingenious artifice that we shall describe.

The steam generator is provided, in addition to its masonry, which is insulating from a thermic point of view, with an iron plate jacket between which and the generator there is an annular space for the circulation of a stratum of air. This jacket also surrounds the chimney up to the top of the roof of the imperial; but the real chimney of the generator debouches in this external chimney at a level of 1·5 meters below the upper orifice. The exhaustion of the gases of combustion and of the steam that has



Figs. 1 & 2.—DETAILS OF THE MECHANISM OF SERPOLLET'S STEAM TRAMCAR.

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been used brings about a strong influx of air into the annular space, and the diffusion of the gases in the air takes place in the conduit before they make their exit into the open air.

On another hand, as the chimney is perfectly concealed behind the front side, it is impossible, at first sight, to recognize the mode of propulsion employed. The motor actuates the axle through the intermedium of two parallel chains, the ratio of the wheels of which is 1 (driving shaft) to 3 (axle).

The chains are so arranged that one of them alone shall be capable of assuring the service. The chain wheels are keyed in such a way that one of them alone shall operate, the other having to operate only in case of breakage of the other. The two axles are rendered interdependent through a third chain.

The transmission by chain makes the carriage roll very easily, while at the same time, on account of the multiplication of speed, it effects an almost constant stress and facilitates starting.

Owing to such arrangements as a whole, the gradients of Clichy Avenue, which reach nearly 5 to 100, are easily traversed at speeds that reach 16 kilometers per hour.

We find again in this new and interesting application of Mr. Serpollet's quick-vaporizing generator all the characteristic general advantages of his invention, and which have so often been brought to notice in connection with previous applications that it seems useless to revert to them. As for the special advantages, we may point out in particular the possibility of approaching and ascending any gradient whatever without loss of speed; the peculiar elasticity of the generator, proportioning at every instant the stress to be overcome; the absence of noise, smoke and odors that other systems of propulsion do not realize to the same degree; the facility of driving; and, finally, the saving in steam resulting from its being used in a superheated state.

These advantages are more than are necessary for assuring steam tramcars of the Serpollet system a certain number of applications, in presence of the opposition met with by the trolley system of electric propulsion on the part of the administrative authorities.—*La Nature.*

Artificial Glaciers.

Teachers who have found it difficult to make the movements of glaciers clear to their pupils may find it helpful to use one of these simple methods, which are given by a German writer. For ice, he substitutes *Yellow Pitch*, the surface layers of which, after exposure to the air, show about the same degree of plasticity and brittleness that ice has. Take a square tray which has a slanting gutter; this gutter must first be lined with a layer of very hot pitch, to prevent the mass from rolling down. Then pour in the rest of the pitch. As it moves downward, cracks are made from the edges toward the center at an angle of 45° to the edges, and join transverse fissures which are produced in the middle. Where the tray widens, longitudinal crevices are produced.

The other method differs from this only in coating the surface of the pitch with a layer of white paint, so that the cracks appear black on white, and are more easily seen. The writer says that particular forms of cracks can always be observed at the same parts of the tray, and that the motion, which has the same kinds of variation noticed in glaciers, can be studied with the microscope.

Limestone Made Into Marble.

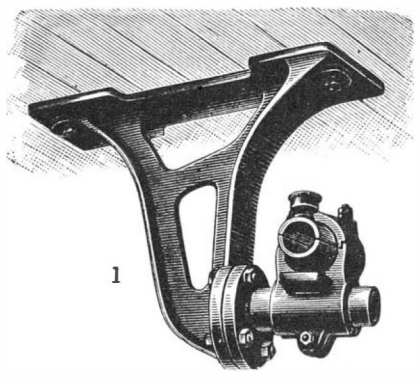
Various modes of coloring limestones have been developed, but the latest that has come under our notice is described in a recent number of *Engineering* as follows:

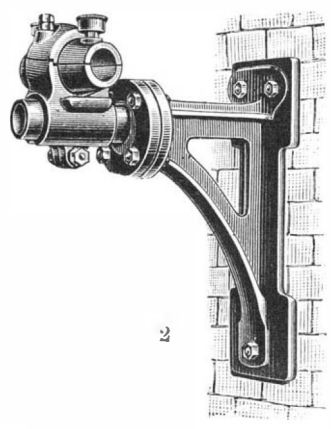
Marble is a natural product, so that this title is perhaps inadmissible, but works have just been started at Chelsea in which the natural process is so closely imitated by chemical means that there is produced so near an approximation to marble as almost to justify the name. Nature's process is hastened, and is more directly under control, so that although the veining may be varied as art demands, there can be a large production of a uniform tint of stone, if desired. The process known as the Moreau-Rae is simple, and by it all limestones or chalk may be converted into the semblance of marble of any tint or combination of shades, while the specific gravity is increased 25 per cent. With limestone, carving or turning is more easily done than with marble. The first process thereafter is to prepare for veining. On the surface of water there is sprinkled a varnish composed of sesquioxide of iron, gum thus and turpentine; and water being unstable, a freedom of design is obtained, especially when the turpentine is broken up by sprinkling of soap. The stone is dipped on the turpentine and subsequently immersed in baths of metallic solutions. These are of sulphates of iron, copper or zinc, separate or in combinations, the specific gravity varying from 1·2 to 1·5. They may be termed the primary colors, and variety of shade is got by different periods of immersion or in varying the order of tanks used. The varnish prevents the sulphates affecting the stone at those points, according to the density of the varnish.

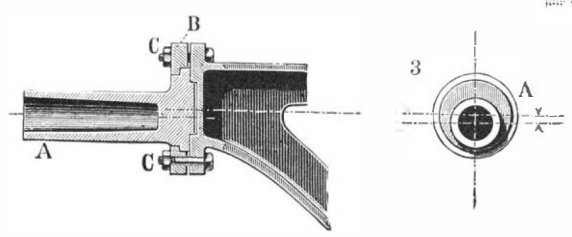
In the case of some French stones where there is a good deal of shell or flint, this process of artificial veining is not necessary, as the same result is got from the existence of shell, and this Marseilles stone has been made into very effective balustrades, as well as fireplaces and table tops. Very dark colors, for instance, are got by using copper and iron sulphates. Zinc and iron alternately give light yellow, while the use of the three in turn gives dark yellow and brown in variegated tints. Black and gold, too, may be got by making the stone yellow before varnishing, after which the black bath is used, so that the veining takes the gold tint. Infinite variety is possible in the manner indicated. After this treatment in the sulphate baths, the stone is immersed in a water bath maintained at 50° Cent. to thoroughly fix the colors, all air meanwhile being expelled; and here it may be stated that the color permeates the full thickness of the stone, as is shown by blocks cut into several thicknesses. The process thus far takes only a few minutes, and the stone is then dried in an oven of a temperature of 90° to 100° Cent., remaining probably for twenty-four hours. It is then immersed for a corresponding period in an indurating bath—in a solution of sulphate of zinc—which does not affect the color, but effectually hardens the stone, closing up the pores, so that when removed it approximates the density and the specific gravity of marble, and has all its beauty and wealth of coloring. It is afterward polished in the usual way.

IMPROVED JOURNAL BOX SUPPORTS.

The construction shown in the accompanying illustration, for the support of journal boxes, is simple







HEY'S ADJUSTABLE JOURNAL BOX SUPPORTS.

and durable, and admits of convenient adjustment according to the position of the shaft. The improvement has been patented by Mr. Jean Hey, of Strasburg, Germany. Figs. 1 and 2 show the application of the improvement in connection with a hanger or bracket support, made to form a pivot to support the bearing, which is arranged to turn eccentrically, and be thus raised or lowered. The circular box, A, eccentric to the axis of support, as shown in longitudinal and cross section in Fig. 3, has an eccentric base flange or disk with a circular offset on its rear face engaging a circular recess on a disk of the hanger or bracket. The base flange or disk is rabbeted, and engaged by a correspondingly rabbeted ring, B, held in place by bolts, C. When the bolts are screwed up the ring clamps the base flange or disk, but when the bolts are loosened a complete revolution may be given to the base of the support, thus permitting a wide range of adjustment.

Long Distance Transmission of Steam.

At a recent meeting of the American Society of Mechanical Engineers, Mr. Eckley B. Coxe described a method he had used in carrying steam a long distance. At a colliery they wished to carry steam to a waterworks about 4,500 feet over a hill from the boiler plant. A trough was made by nailing the edges of two boards together, so that they formed a right angle. The trough was supported by two stakes driven in the ground, and crossing just beneath the trough. The pipe was laid in the trough resting n cast iron plates, the pipes surrounded by mineral wool, and a similar inverted trough placed over the top. To allow expansion, a bend was made to one side at the top of the hill, and then it was turned back to its original direction. A large receiver was introduced in the pipe at the pumps. This was made of three sheets of an old boiler, and was 34 inches in diameter. This also served as a separator. As the elevation was 1,800 feet above the sea, the cold was excessive in the winter time, but this arrangement has been in use since 1877, has cost nothing for maintenance, and has given no trouble. Mr. Coxe believed that the secret in carrying steam long distances to an engine without causing a drop in the steam pressure was in the use of a receiver or reservoir.

Our Exports of Ferro-Manganese.*

A short time ago the *Engineering and Mining Journal* called attention to the wonderfully low cost at which pig iron is being produced at well located furnaces in Alabama, the figure given, viz., $6.37 per ton, being, we believe, lower than anywhere else in the world. We can now claim also that ferro-manganese is being produced in this country at a lower cost than anywhere abroad, and the credit for this is due to the Carnegie Works, which have always been in the van of industrial improvements, and which have been one of the chief producers of ferro-manganese for many years past. So successful have they been in reducing the cost of production that they are now able to ship ferro-manganese from Baltimore to Glasgow, Antwerp, Hamburg, and Rotterdam, sending more than one thousand tons in October, November, and December, 1893, and a certain amount also from New York, while more than 1,200 tons have been shipped in the first two months of the present year. We are not advised as to whether any was shipped from Philadelphia also.

A part of this ferro-manganese has been exported under the name "manganese ore," but there is no mystery as to what the material actually was. The invoiced value was a little less than two cents per pound, or about $44 per gross ton. At present the market quotations of ferro-manganese are $52 to $53 per ton in Pittsburg, the present import duty being three-tenths of one cent per pound, or $6.72 per gross ton. Ferro-manganese and spiegeleisen are very important products used in steel making, and our consumption of them may be appreciated from the fact that the production of spiegeleisen and ferro-manganese in 1892 amounted to 179,131 gross tons, though in 1893 it declined to 81,118 tons. The high price of the product has caused earnest search to be made in this country for an ore well suited for its production, and numerous mines have been opened, but for one reason and another they have not succeeded in supplying the demand. The production of manganese ore in 1892 was 19,117 gross tons, and in 1893 it reached only 9,150 tons, a decline almost proportionate with the falling off in the output of spiegel and ferro. The remainder of the ore used comes from the imports of iron ore (including manganiferous ores) which, in 1892, amounted to 806,585 tons and in 1893 to 526,951 tons.

The Carnegie Company certainly deserves the highest commendation for the skill shown in the economical management of its plant, which has enabled it not only to produce steel rails in competition with the world, but to make ferro-manganese in part from imported ores, and actually export it to the home of ferro production, Belgium.

Origin of the Dollar Mark—Five Theories.

Below I give five theories of the origin of the dollar mark ($), they being selected from about twenty seemingly plausible solutions:

1. That it is a combination of "U. S.," the initials of the United States.

2. That it is a modification of the figure 8, the dollar being formerly called a "piece of eight."

3. That it is derived from a representation of the pillars of Hercules, consisting of two needle-like towers or pillars connected with a scroll. The old Spanish coins marked with the pillar device were frequently referred to as "pillar dollars."

4. That it is a combination of "H. S.," the ancient Roman mark of money unit.

5. That it is a combination of P and S, from peso duro, signifying "hard dollar." In Spanish accounts peso is contracted by writing the S over the P, and placing it after the sum.

According to one writer the symbol of the dollar is a monogram of the letters "V," "S," and "J," the dollar being originally a "thaler," coined in the valley of Sankt Joachim, Bohemia, and known as a "Joachims thaler," and the monogram the initials of the words, "Valley Sankt Joachm." A writer in giving his opinion of "Reason No. 3," as given above, says:

"The American symbol for dollar is taken from the Spanish dollar, and the origin of the sign, of course, must be looked for in associations of Spanish coins. On the reverse of the Spanish dollar is a representation of the pillars of Hercules, and around each pillar is a scroll with the inscription 'plus ultra.' This device in course of time has degenerated into the sign which at present stands for American as well as Spanish dollars, '$.' The scroll around the pillars represents the two serpents sent by Juno to destroy Hercules in his cradle in mythologic lore."—*St. Louis Republic.*

* From the *Engineering and Mining Journal.*

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CARBORUNDUM.

Carborundum, the new abradent, according to the inventor or discoverer, is the result of both invention and discovery. It was produced after long research and careful and intelligent experimentation, and in its production the inventor made the important discovery that carbon and silica would, under favorable conditions, combine to form a definite compound which was hitherto unknown.

Mr. E. G. Acheson, the fortunate inventor of the new abradent, made his first experiments in this direction in the laboratory of Mr. T. A. Edison, when that institution was located at Menlo Park, N. J. These experiments, which were productive of small results, were followed by others at Gosford, Pa., and again at a later date at Monongahela, Pa., where all the facilities of an electric lighting station were available for the work.

The first experiment in the latter place, which was made in 1891, consisted in mixing carbon and clay together and subjecting the mixture to a high temperature produced by electricity. An examination of the mass after cooling disclosed minute crystals of a dark blue color, which were very hard and of a bright luster. The experimenter, with considerable anxiety and some expectation, tested these small particles for hardness. In his tests nothing available escaped; he even submitted a handsome diamond ring to the abrasive action of these crystals, thus spoiling the appearance of the stone. After this, many experiments in methods, mixtures and apparatus were made, and facilities were increased. About this time the inventor carried to New York the entire amount of material produced during two months, and this was all contained in a two ounce vial.

Early in the experiments it was found that the silica, and not the alumina of the clay, was the more important factor in the formation of the crystals. Sand was substituted for the clay—an experiment which resulted in a very much greater production from a given quantity of material. The color of the crystals was found to be a light green instead of blue, as was the case with the clay. Subsequently chloride of sodium was introduced into the mixture, not as essential to the manufacture, but as a cementive to cause the fine particles to adhere together, thus facilitating the removal of the crystals after they were cooled.

After having thus arrived at methods for producing a uniform product, and one which gave promise of fulfilling all the requirements of an abradent, the inventor entered into a thorough chemical investigation in order to increase the amount of production, so as to place the new material on the market. At this stage of the business a company was organized under the laws of Pennsylvania, entitled "The Carborundum Company." In the meantime efforts were made to introduce the carborundum into the diamond cutting industry. Some of the material was introduced among the diamond cutters of Amsterdam, Holland.

The crystals were found to be too brittle for charging a lap for the first cutting or roughing, but it proved as efficient as diamond powder for finishing. At this time the production had been increased to about three pounds per day. The carborundum first produced was placed at $10 per pound, but within a short time it was reduced to $4 per pound.

In 1892 the manufacture of wheels, hones and the many other forms in which emery and corundum are used, was undertaken. A vitrified bond was adopted as being the most suitable for holding together the carborundum particles. Hydraulic presses were procured for pressing the carborundum and binding material into the desired forms. A pottery kiln was built for vitrifying the goods.

The product being still quite small, it was used up in the manufacture of small wheels and points for dentists. Twelve thousand sample wheels, one-half inch in diameter and one-sixteenth of an inch thick, were mailed to the same number of dentists. The manner in which these wheels were received by the dentists, and the great superiority of carborundum for their uses, is told in the statement that in a period of one year about two hundred thousand wheels and points were disposed of to this trade alone. Large numbers of these wheels are used by the Westinghouse Electric and Manufacturing Company for the manufacture of the "ground stopper lamps." A dozen of these wheels were ordered by this company for a trial. As a result of this trial, the company, it is stated, have used these wheels to the exclusion of all others, and their orders up to January 4, 1894, amounted to over sixty-four thousand wheels.

Before March, 1893, the amount of carborundum produced was not sufficient to warrant active work on its introduction for machine and general metal work. The first wheels placed on the market were not turned or trued up; on this account they did not prove entirely satisfactory in operation. As soon as this imperfection was noted, the manufacturers introduced apparatus for turning and truing the wheels.

The present plant consists of a 225 horse power Russel engine, 150 horse power Wheeler boiler, a 60 horse power Babcock & Wilcox boiler, and a 112,000 watt Westinghouse alternating dynamo, with the various special pieces of machinery necessary for working up the new material.

Our front page engraving illustrates the various steps in the manufacture of carborundum, and gives a faithful portrait of its persistent inventor.

Ordinary Connellsville coke is used, being crushed and ground in barrels to a fine powder. A good quality of glass sand and ordinary dairy salt are mixed with the coke, the proportions in some cases being: Coke, 20 parts; sand, 25; salt, 5 parts. This mixture is placed in the furnace and subjected to the intense heat produced in a central core of carbon by the passage of a current of electricity. This core, formed of broken coke, is placed in the furnace in the center of the carborundum mixture, which is in the form of a hollow cylinder, its size depending on the size of the furnace. In the furnace illustrated it is about eight inches in diameter. The electricity is introduced to the core by means of rods of carbon, two inches in diameter, nine in number, at each end.

From ten to fourteen hours are required to complete the operation of a furnace, the amperes being from 150 to 1,000 during the process. After cooling, the walls of the furnace are taken down, the top crust thrown off, and the carborundum removed. The illustration shows a furnace partly discharged. Surrounding the cylinder of carborundum crystals is a layer of loose white material, having the same composition as carborundum, but lacking in crystallization.

After removal from the furnace the carborundum is thrown into a grinding mill, where the crystals are separated by a crushing action. They are then thrown into a stream of water, passing through a series of tanks, of increasing sizes, where they are sized or graded. The graded crystals are mixed with an appropriate binding material, and moulded (as shown). After moulding, the prepared forms are placed in "saggers," and these again are placed in a potter's kiln and fired. The firing requires from four to six days, depending on the sizes of the wheels in the kiln. After removal from the kiln the larger wheels, intended for metal or machine work, are turned or trued up (see illustration). This turning up is performed either with one of the mechanical tools ordinarily used, and consisting of star-shaped wheels of steel, or with a diamond point; in either case the principle is to tear the crystals from the binding material.

The quantity of carborundum manufactured during 1893 amounted to 15,200 pounds.

Mr. Acheson has recently sold his Austrian patent on carborundum to the Landerbank, of Vienna, and an engineer has been sent over to attend to the erection of works at Prague.

A New System of Fishing.

Mr. G. Trouve has recently published a paper in which he describes a new system of fishing of his invention which permits of taking fish automatically, and which, he claims, may be applied with the same success in lakes, rivers, canals, gulfs, on the coast and in the open sea. The arrangement is applicable to nearly every kind of net now in use, with slight modifications.

In Mr. Trouve's system of nets the foot rope is provided with a purse and is weighted with lead, as usual, and for the head rope there is substituted a flattened rubber tube cemented by a flexible rubber tube with a reservoir of compressed air or with a simple or double acting pump. This compressed air reservoir is placed, according to circumstances, either in a boat or upon the shore, or else is inclosed in a special buoy to be mentioned further along. If a pump is employed, it, too, may be installed in a boat or upon the shore.

Let us suppose that the arrangement is applied to a circular net. The latter, having been cast in the usual manner, sinks to the bottom under the action of its own weight, where it forms an immovable heap of relatively slight bulk, which, by reason of this very fact, will not attract the attention of the fish. The fish are afterward lured to the spot circumscribed by the net by means of bait of different kinds and by light, etc.

When the moment is deemed propitious for a good catch, the pump is set in motion and the cock placed upon the compressed air pipe is opened, so as to allow the air to enter the rubber tube that encircles the top of the net. As this tube becomes inflated, it describes a wide circle, and, rising toward the surface, carries the net along with it without any noise and without agitating the water. The attention of the fish is therefore not awakened and they are captured without knowing it, and before they have even attempted to make their escape.

After the catch has been taken from the net, the compressed air that fills the tube is allowed to escape, and the net again sinks and is ready for a second operation.

Mr. Trouve's buoys, mentioned above, contain electric apparatus in the form of batteries or accumulators and carry one or more incandescent lamps that are surmounted by a flattish reflector which sends the luminous rays over a very wide surface. They likewise contain a reservoir of compressed air, which is connected by a flexible tube with the tube that borders the top of the net. The flexible tube is provided with a three-way cock that puts the interior of the net tube in connection with the interior of the air reservoir, or with the external air, or prevents egress of the air. This cock is maneuvered by hand or by a clockwork movement started electrically and inclosed in the buoy. This clockwork movement may also be controlled from the shore or from a boat.

The bait employed (worms, frogs, small fish, etc.) is placed in a basket having several compartments and which is suspended from the luminous buoy.

Mr. Trouve has likewise devised a sort of balance, which is placed within the net, and by means of which can be approximately calculated the weight of the fish that may be taken by the apparatus lying at the bottom of the water.

Maintaining Streets Without and With Car Tracks.

In a paper read before a meeting of the Massachusetts Highway Association, by W. L. Dickinson, vice-president of the association and superintendent of streets in Springfield, Mass., he says:

We have been obliged to pave some of our streets with granite blocks, where there was a car track in the center, because it was impossible to keep the track in a safe condition with crushed stone. In fact, we have no streets with granite block paving without a street car track in the center, and there are several miles of gravel and macadamized streets with a track in the center that are costing a large sum for maintenance every year without good results, and it would be economy to pave them. If the car tracks were not in these streets, the traffic would be distributed over the entire roadway and the cost of maintenance would be small. It is generally acknowledged by men familiar with traffic and its injurious effects upon our streets, that when a street car track is laid in any ordinary width street it quickly increases the cost of maintenance and makes it impossible to keep the road in good condition for travel. Whatever road material you use, be it granite blocks, asphalt, brick or crushed stone, the poorest costs the most for maintenance. With the introduction of electricity as a motive power the mileage of street car tracks is increasing rapidly, and they will soon have the main arteries in our cities and towns girdled with electric railways. I have selected a few macadamized streets under various conditions of traffic in different parts of the city of which I can get a perfect record from the books of the highway department for the purpose of illustration and comparison.

From the figures we find that on residential streets with a moderate traffic and driveway of 30 feet from curb to curb, unincumbered with street car tracks, so that the traffic is distributed over the entire surface, it is possible to furnish the traveling public with a good surface of macadam pavement at an average annual cost of 0·013 per square yard for maintenance. On the other hand, when you put a track in the center and confine the traffic to a narrow space each side, the horses and wagons constantly traveling in the same place will, with the immense pressure per square inch brought to bear, grind the pavements into dust and mud. When you place a car track in the center of a street it occupies a position which was originally intended, when the pavements were first laid, to carry the bulk of the traffic.

Under these conditions it is not at all surprising that on a street which receives but a moderate traffic, the cost of maintenance with no car track in center is increased from 0·013 to 0·063 with the track in the center. These figures are the average for fourteen years. The average annual cost of maintenance per square yard on Dwight Street is 0·0134, on Water 0·021+. These streets have no car track in center, are in a business portion of the city, and receive a heavy traffic, yet the cost of maintenance is small compared with Maple and Central Streets, which are residential streets. These two streets have a car track in center and receive only a moderate traffic, but the average annual cost of maintenance is 0·063 per square yard, or $610 per mile.

Summer Street is the approach to the New York and New England freight depot, was macadamized in the summer of 1892, and is subject to a very heavy travel, though the cost of maintenance annually is only 0·0055+ per square yard; while on St. James Avenue, macadamized the same year as Summer Street and one of the main arteries in the residential portion of the city, but receiving only an average traffic, has a street car track in center, and costs 0·141+ per square yard. Of course it must be understood that these results are obtained by the use of a fine quality of trap rock which comes from the quarries at Westfield, Mass., and Meriden, Conn., and is as good material for macadamizing streets as there is in the country. Undoubtedly with poorer material the cost of maintenance would be greatly increased, especially with the traffic confined to a narrow space each side of a car track.

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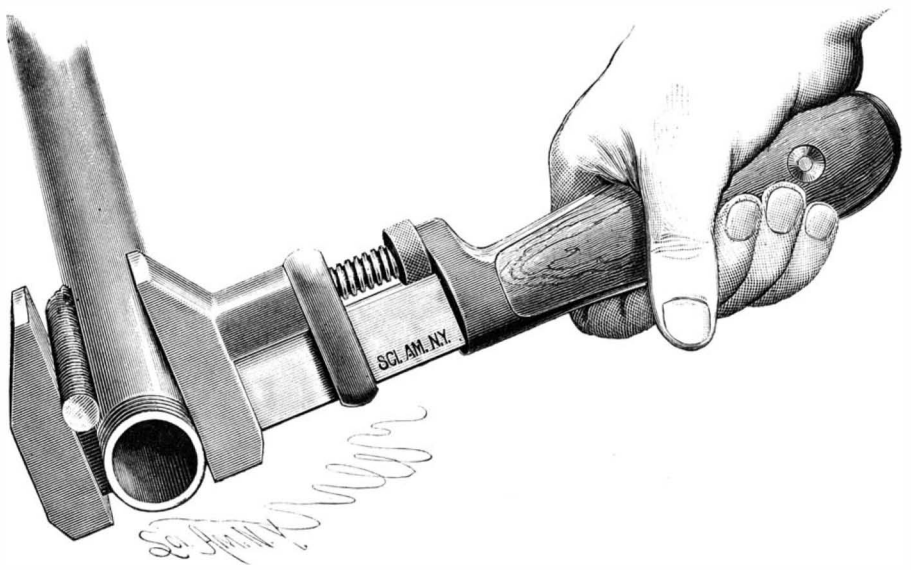
SUBSTITUTE FOR PIPE TONGS.

The man who is full of expedients is the one who gets along in the world. If what he wants is not at hand, something else is substituted, and matters progress as though every facility were available.

This applies especially in mechanics, where it is impossible to provide a tool for everything, and when just the tool required—even though there be such a tool—is not at hand.

Our artist recently saw a mechanic who, desiring to unscrew a pipe, and not having pipe tongs or any of the usual appliances for such work, picked up a wrench and a piece of a round file and applied them in the manner shown in the cut. In an instant, and without difficulty, the pipe was loosened.



SUBSTITUTE FOR PIPE TONGS.

Waterproof Cellars.

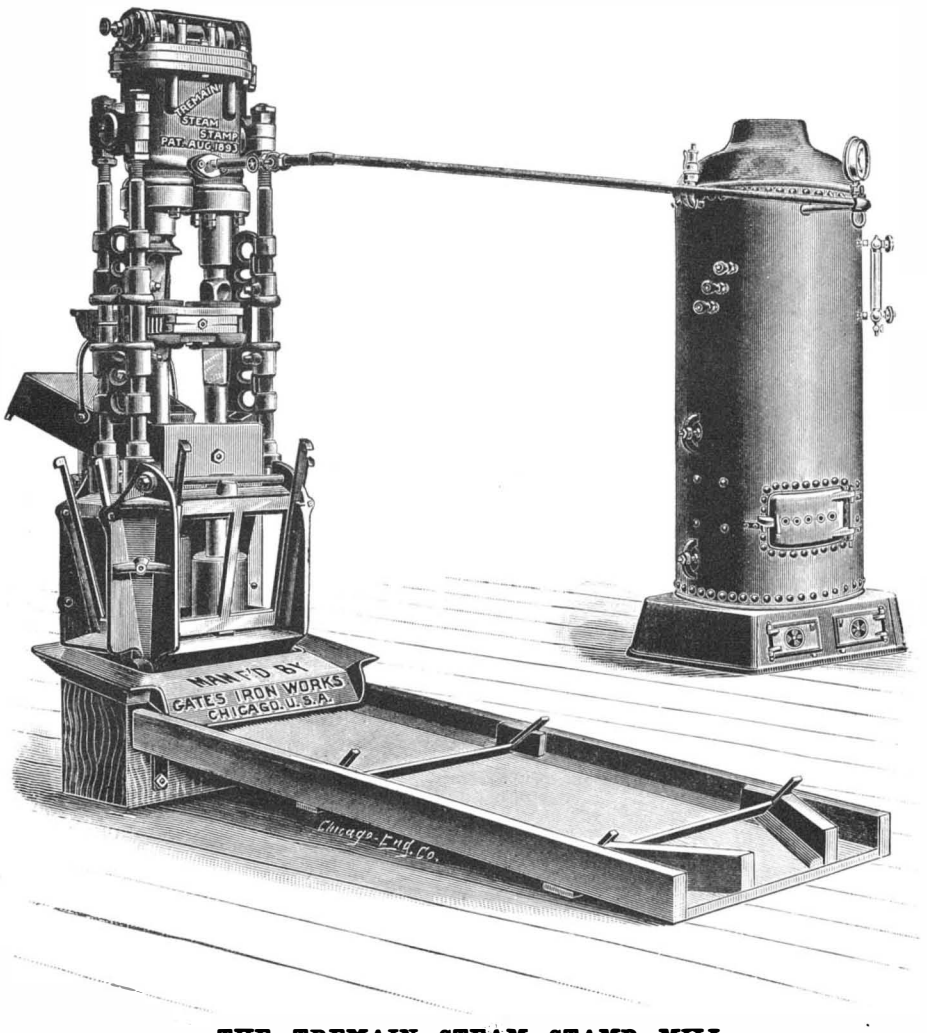
A cellar can be so constructed as to be waterproof, if the bottom or the floor is first covered with cement, the walls built thereon laid in cement and the exterior of the walls covered with cement.

This makes practically a water-tight basin. The cement used must be the best Portland cement, one part; clean sharp sand, one part. After a cellar is built it is not so easy to make it waterproof. Still it can be done. Cover the exterior of the wall with the above cement, ditto the bottom, and work the cement in under the bottom of the wall.

If these directions are followed, you will succeed. But if cheap materials are used and the work badly done, you will be sure to fail. A drain put around the outside of the wall, or even inside, below the cellar floor, may be efficient in carrying off the water if you can give it a good delivery.—*The National Builder.*

A PRACTICAL STEAM STAMP MILL.

A mill designed to supersede the old style cumbersome and expensive stamp mills, requiring a large expenditure of power for their operation, is shown in the accompanying illustration. The machine crushes to fine powder the gold or metal bearing quartz or rock, so that the minerals may be easily collected by concentration or amalgamation. Its height is 7 feet 6½ inches and its base 18 by 22 inches, and yet it has a capacity equal to the ordinary five stamp mill, and can be introduced and put in operation at less than half the cost. It has one screen 14 by 18 inches and two 14 by 7 inches, and the weight of the complete mill with feeder is only about 2,700 pounds. The mill is made in sections, easily put together, the heaviest piece weighing only 340 pounds, to facilitate transportation by pack animals to mining localities difficult of access. The mill has two stamps, each with a stamp stem, and weighing, with piston rod and other attachments, about 300 pounds each. The stamp is raised by the admission of steam to the under side of the piston, after which the steam is conducted to the top side of the piston, by a novel arrangement of parts, and its pressure applied over a much larger area, whereby the blow struck by the stamp is given a largely multiplied force. The steam is made to do the work directly, thus adding greatly to the efficiency of the machine, and effecting a saving of at least three-fourths of the cost of fuel as compared with former methods. The foundation is easily prepared, preferably by setting timbers on end to reach bed rock, or by setting them eight to ten feet in the ground, upon timbers arranged to form a solid foundation. The machinery runs independent of a building, and may be set up under a shed. When run with a boiler which gives a hundred pounds steam pressure, the blow struck will equal that of a thousand pound stamp, but the force of the blow may be regulated in a manner similar to that of the steam hammer. About five horse power is sufficient to run the stamp. This machine has been in successful operation for about two years, and its simplicity and great efficiency have earned for it the high commendation of experienced miners. It is manufactured by the Gates Iron Works, of Chicago, manufacturers also of a large line of general mining machinery.



THE TREMAIN STEAM STAMP MILL.

The Ice Rink.

Skating on real ice in summer attire is rapidly becoming one of the most popular indoor amusements in San Francisco. To native sons and daughters who have never experienced the rigors of an Eastern winter, it is a thrilling novelty. To those who have enjoyed the exhilarating sport in a land of blizzards and frosts, it is made more enjoyable by the fact that winter dress is unnecessary.

These are only a few of the reasons why the frozen lake in the big Mechanics' Pavilion, with nearly 10,000 square feet of polished surface, is visited daily by hundreds who can skate and many who are speedily learning. The sheet of ice is five inches in thickness, 160 feet long, and 60 feet wide. At least 500 persons can skate with comfort at a time, but it was a trifle crowded on the opening night, for no less than 811 glided or struggled over the slippery surface, according to the respective skill of the skate wearers.

"This idea of a big skating rink with natural ice," said W. W. Donaldson, "is not exactly a new one in this country. Right here in this city it has been tried three times, but each attempt failed because the organizers did not master the intricate mechanical appliances. This is the first natural ice skating rink operated in the United States, and the fourth in the world. There is one in Paris, another in Berlin, and a third in Southampton, England. Therefore this is the fourth in the world, and the first in the United States. The successful construction of this rink is the result of ten years of careful study and experiments on my part while engaged in the cold storage business. I was preparing a similar rink in Chicago when the disastrous fire destroyed the big cold storage building at the World's Fair. The plant being destroyed, we had to abandon the project.

"How is this natural ice produced? There is no secret about it. The ice is produced by a machine of the ordinary type employed in cold storage work. The difference here is in the manner of freezing. In cold storage it is done in tanks and insulated rooms. Here the ice is frozen three times a day, and the refrigerant used is anhydrous ammonia. This is employed to cool the strong brine. After the brine is cooled it is pumped through a system of pipes 40,000 feet in length, which run through the water that is turned into ice. The cold brine absorbs the heat. The floor beneath is insulated and made up of dead air cells and covered with lead to make it watertight.

"In the placing of the pipes lies the principal secret. The pipes run in three centers from a header at each end of the tank. These headers are six inches in diameter, and the pipe is taken out of each header at six inch centers. This admits of circulating the brine from both ends at the same time. The return is also taken from both ends and carried back to the brine tank. By this means we have a cooling surface exposed to the outside air. In this way we outwit nature, and our ice surface has an even temperature all over. Through inch pipes leading from the headers the brine is kept in constant motion.

"Of course, after being used several hours the surface of the ice becomes cut up and somewhat rough. That is why we have three sessions daily—morning, noon, and night. During the intervals the snow is swept off the ice, and with a hose or orchard sprayer a thin coating of water is spread over the ice to fill up the cuts. In this manner we have a perfectly smooth surface three times a day. The water is frozen at a temperature of about ten degrees above zero, which would be as cold, probably, and as hard as ice frozen in any cold country when the temperature is about zero.—*San Francisco Call.*

An Important Patent Suit.

The case of the Bate Refrigerating Company was recently argued before the United States Circuit Court of Appeals, C. E. Mitchell and J. C. Carter appearing for the appellant and W. H. Peckham and Edmund Wetmore for the appellees.

The point at issue is in regard to the meaning of the part of the paragraph of section 4,887 of the Revised Statutes reading as follows: "But every patent granted for an invention which has been previously patented in a foreign country shall be so limited as to expire at the same time with the foreign patent," the appellant contending that it should be construed to read "an invention which has been patented previous to the application for a patent therefor in the United States shall be limited," etc., while the appellees contend that the meaning is plain as it is.

The main argument of the appellant is that in the revision of the law on the subject the language had been so changed as to thwart the plain intent of the original framers of the law, and that the statute is therefore open to interpretation, and should be construed as above in harmony with the original law, and thus prevent great injustice to patentees. The appellees dispute the right to enter upon an inquiry as to the supposed intention of Congress, show that the courts have invariably maintained their view, and argue that if the construction claimed is allowed, it will result in gross injustice to the public.

The System of Algol.

An elaborate discussion of the inequalities in the period of Algol recently led Mr. Chandler to conclude that there is a distant dark body around which the bright star and the dark companion producing eclipses revolve in a period of 130 years (*Nature*, vol. xlv., p. 446). This conclusion has been greatly strengthened by recent investigation by Mr. Searle of the relative places of Algol and comparison stars from observations made with the meridian circle at Harvard College (*Annals*, vol. xxix., 1893). The right ascension of the star appears to be increasing in general conformity with Chandler's prediction.

THE "digue," or breakwater, of Cherbourg is one of the boldest engineering feats ever preformed.

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A VERY HIGH WINDMILL.

One of the highest windmill towers in this country, if not the highest in the world, has recently been erected at St. James, L. I., by Mr. Andrew J. Corcoran, the designer, engineer, and constructor, of New York City, who has attained a world-wide reputation in the building of windmills. The tower is 150 feet high, and is declared by Mr. Corcoran to be "the highest and the strongest windmill tower in the world." The great height of the tower was made necessary from the fact that the spring from which a supply of water was to be pumped was hemmed in by bluffs, and the bottom of the wheel had to be sufficiently elevated to be above all obstructions within a radius of about one thousand feet.

The windmill is on the estate of Mr. Prescott Hall Butler, and the reservoir which the pump supplies is more than a mile distant. There are 6,000 feet of pipe between the pump and the reservoir, and the water has to be elevated to a height of 223 feet. The reservoir has a capacity of 65,000 gallons, and the windmill has frequently pumped this quantity into the reservoir in two days' time.

The spring is on a little sand bar, overflowed at high tide, and the 4 inch flowing well had to be protected from the salt water. The foundation is 46 feet square, and consists of eight piers, one at each corner and one under the center of each side. The corner piers were started on a cribwork of locust logs, 10 inches in diameter, covered with a 3 inch hemlock planking, forming a support for a mass of well-puddled sand and gravel. On this comes a 6 inch concrete foundation for a 5 foot brick pier, to which the iron plates are attached by three rods running through to the locust cribwork. The base plates are special castings inclined so as to give the proper batter to the columns, and provided with sockets in which the timbers are given a firm seat. The remaining piers are somewhat lighter. The framework of the first 125 feet of the tower is built of the heaviest yellow pine framing, three struts 6 inches square for each corner post and 6 × 10 inch struts for the center columns, all braced together by heavy diagonal timbers. The bolts and other iron work in the tower weighed about six tons. The tower is divided vertically into a number of flights or stories, from 12 to 15 feet high, connected by stairways affording easy access to the top, which forms an excellent observatory 20 feet square, provided with a strong railing. The top 25 feet of the tower forms the base proper of the wheel, which is 22½ feet in diameter and of the Corcoran type. The construction of the joints in a wooden tower of this height was a matter of some difficulty, owing to the wind strains, but the trouble was overcome by gusset plates, heavy bolting, and re-enforcing plates, so that the spring from base to platform is practically uniform.

Since 1858 the manufacture of windmills has been a specialty with Mr. Corcoran, who now makes his standard mills in fourteen sizes, and pumps adapted to raise water to a height of 2,000 feet if necessary. Mr. Corcoran has built many other high towers for windmills of large capacity, including one for Mr. Stanley Mortimer, of Roslyn, 103 feet high, one for Mr. J. F. D. Lanier, at Wheatley Hills, 106 feet high, and one for Mr. W. P. Douglas, at Little Neck, 125 feet high; but the one for Mr. Butler, shown in our picture, overtops them all, and forms the most prominent landmark on the Long Island side of the Sound.

A WINDMILL 150 FEET HIGH AT ST. JAMES, L. I.

Repairing Foundations.

The American Architect says: An ingenious method of repairing foundation work injured by springs was recently employed on the North Sea Canal, the great waterway which connects Amsterdam with the North Sea. Of late years, the commerce of Amsterdam has rapidly increased, and the locks at the entrance of the canal, which protect it against the influence of the tides, are no longer capacious enough to accommodate the traffic, or large enough to admit the immense steamers which would make Amsterdam their port if they could. Two years ago, it was resolved to build a new lock, of the requisite size, and the work has since been going on. The foundation of the immense lock walls is of concrete. All precautions were taken in laying the concrete, and the bed was inclosed with sheet piling, and pumped nearly dry before the foundation was laid; but, before beginning the excavation, several borings had been made, which pierced the stratum of clay underlying the basin; and, on pumping out the excavation, the water rushed in great jets through these holes, as it would from an artesian well. The concrete was laid over these jets, but the cement was washed out of it by the water to such an extent that the skillful engineers in charge of the work, MM. Van Meren and Bekaar, resolved not to leave such doubtful spots in the foundation, but to strengthen them by some means. MM. Mortier and Thouvard, contractors, have the honor of suggesting to the government engineers the plan which was finally adopted, and which they were employed to carry out. Briefly, their proposition was to suppress the springs by means of compressed air, until the concrete put over them could harden sufficiently to be out of danger from them. In order to apply the compressed air, the contractors first moulded domes of concrete, about thirty feet in diameter, but varying according to the dimensions of the spot of imperfect foundation which it was desired to make good, and with a shell three or four feet thick. In the top of each of these, an air lock, consisting of an iron cylinder, with the necessary doors, was set, and through the air lock the workmen passed in and out, and materials were carried. A pipe was driven through the foundation, outside the dome, to the spring beneath it, so as to give an escape for the water; and air was then forced into the dome. As there was no escape for the air, the dome being firmly cemented to the sound part of the foundation, the flow of the spring was checked, and finally reversed, the water discharging through the pipe over the surface of the firm concrete outside. Meanwhile, the workmen under the dome dug out the washed and crumbling concrete, which was passed out through the air lock and fresh concrete put in its place. The new concrete, being no longer exposed to washing, soon became as hard as that around it, and capable of resisting perfectly the effect of the springs. In this way all the doubtful spots were repaired, and the stone walls of the lock are now being laid, on a foundation which *Le Genie Civil* calls "irreproachable."

African Diamonds.

The African diamond fields are in the Orange Free State, where there is one important mine at Jagersfontein, and in the British colony of Griqua Land West, where there are four. Of these, the best known are the Kimberley mine and the De Beers, the latter of which was so admirably illustrated in last summer's Columbian Exhibition.

It is but twenty-five years since the gems were discovered on the Dark Continent, and the value of the annual yield now exceeds $20,000,000. It is interesting to note that notwithstanding these large quantities are mined and that diamonds have been so successfully imitated, their value has not declined more than a dollar a carat.

The South African mines have yielded larger stones than any found in Brazil or India. Some of them are of a yellow tint, and therefore of low value; but the De Beers diamond (428½ carats) and the Jagersfontein (969½ carats), the last found less than a year ago, are perfectly white. These weights are for the rough diamonds, but the Kohinoor weighed only 192 carats, and was reduced by cutting to 102¾ carats.

The Kimberley mine has been worked to a depth of 400 feet, and vertical shafts have now superseded the inclined ones formerly used as means of entrance.

The quantity and value of the African gems in the market have made great changes in the diamond trade. The Brazilian gravels are now worked very little, as are the fields in India and Borneo. London is the diamond market of the world.

Decision on Pipe Cutters.

In 1891 suit was brought in the United States Circuit Court for the Southern District of New York against James P. Allen, a clerk in the employ of the Armstrong Manufacturing Co., Bridgeport, Conn., for an infringement of the Saunders patent, No. 10,031, dated January 31, 1882. The Armstrong Manufacturing Co. at once stepped in and assumed the defense. After nearly two years occupied in the taking of testimony, the case came to final hearing before Judge Wheeler, who, on November 29, 1892, handed down an opinion in favor of the Armstrong Co., holding that the Armstrong pipe cutter did not infringe the Saunders patent. The case was then appealed and heard in February, 1894, by a full bench, composed of Judges Wallace, Lacomb, and Shipman, who have just handed down an opinion written by Judge Lacomb in favor of the defendants, affirming Judge Wheeler's decision and sustaining every point raised by the Armstrong Manufacturing Co. The opinion holds that the pipe cutter claimed in the second claim of the Saunders patent did not cover the Armstrong pipe cutter, and that consequently the defendants are entitled to a decree dismissing the suit with costs. This ends a litigation which has been fought with uncommon vigor, the printed matter alone having run up to over five hundred pages. The result is a source of especial gratification to the Armstrong Manufacturing Co.

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Correspondence.

The Arizona Camels.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN dated March 17, 1894, you copy an article from the San Francisco *Chronicle*, "Wild Camels in Arizona," giving a history of their introduction into that country. These camels, or part of them, are without doubt descendants of a lot that were imported by the United States government just before the civil war, and were used to forward supplies from this city to the different forts then scattered throughout Western Texas. When Texas seceded from the Union all government stores in this city were confiscated or appropriated by the Confederacy, and among them were about fifty camels, which were made to do duty as transports between this city and Forts Dancan and Clark. The superintendent in 1862 of this camel train was W. D. Marshall, who is now living in this city, and with whom the writer is personally acquainted. After the war, these camels were again taken possession of by the United States government, and for a year or more were herded at Camp Verde, about sixty miles northwest of this city, but were not serviceable, as the rocks were too severe on the feet of the camels, and did not prove a success, for the purpose for which they were imported.

The writer's father then lived a few miles from Camp Verde, and often heard him, in after years, speak of these camels, and that the government afterward sent them out to Arizona, and even there, not proving serviceable, were turned loose to shift for themselves. While I do not doubt the correctness of the article copied from the *Chronicle*, some of the herd now roaming in the wilds of Arizona are evidently the increase of the herd sent there after the war from Texas by the United States government. E. S.

San Antonio, Texas, March 21, 1894.

Wool Dyeing: its Principles and Practice.

The various processes employed in dyeing wool are based upon certain principles, upon the observance of which depends in great part the result. These principles are frequently disregarded, and in consequence the result of the dyeing operation is unsatisfactory. It is evident that all the methods of dyeing wool, silk, cotton, or any other fiber must be in conformity both with the properties of the fiber to be dyed and with those of the dye stuffs. Wool is treated differently from cotton, and a dyeing method giving good results upon cotton would, when employed for wool or silk, give either bad or mediocre results; and *vice versa*, a method excellent for wool or silk cannot be used for cotton, owing to the different characteristics of the fiber. Wool has the property of resisting to a high degree the influence of acids, so that it can without injury be treated with strong acids. On the other hand, it is very sensitive to alkalies and alkaline solutions, which affect it to a high degree. Caustic alkalies quickly dissolve wool, and therefore must not be employed in wool dyeing. The carbonates do not have quite so corroding an action on wool, and can be used to a limited degree—that is, in medium strong solutions. Soap has no decomposing effect upon wool, for which reason soap solutions can be used for cleaning and dyeing. In like manner ammonia has no effect, and can therefore be used in place of soap solutions. One characteristic of wool is worth mentioning here, and that is its inclination to felt. When boiled in water and well worked through in this bath, its fibers interlace and form a firmly cohering mass. This tendency must be counteracted as much as possible in cleaning as well as in dyeing wool. It depends much upon the temperature and condition of the bath in which the wool is treated. Too high a temperature and too long a treatment in the bath increase the danger of felting. For this reason a prolonged treatment during boiling must be avoided.

Again, the condition of the bath exerts some influence in this respect. It has been observed that an alkaline bath materially increases the possibility of felting, so that the use of caustic or carbonate alkalies must be avoided. Strong solutions of soap also readily affect felting, and must be either used in limited quantity only or be dispensed with entirely. Ammonia has not so strong a felting effect as the other alkalies.

Acids, on the contrary, prevent the felting; and this is of importance in wool dyeing, because the acid condition of the dye bath is for this staple one of the principal requirements. Alkali salts—for instance, Glauber's salt and table salt—have little or no influence upon the felting, and may be added to the dye bath. Indeed, in many instances they are of advantage in improving the quality of the color. These remarks about wool apply to all other animal fibers, horse hair, rabbit hair, etc., although each kind has a special property of its own as regards its power of resistance to acids and alkalies.

Another point of importance in the dyeing of wool is the varying properties of the dye stuffs employed. It is plain that dye stuffs such as fuchsine or saffranine, for instance, which possess a great affinity for the fiber, must be employed in a different manner from those which do not possess a direct affinity, such as alizarin and gambine, and, again, from those requiring a mordant before they can be used for dyeing. The successful production of the color to be dyed depends upon the minute observance of all these varying conditions.—*Textile Manufacturer.*

Hairy People of Ainu, Japan.

Fresh and important information on the Ainu, the strange, hairy people who inhabit the island of Yezo, in the Japan empire, is given in the modest volume lately published by John Murray. It is written by A. H. Savage Landor, a grandson of the poet, and a clever artist. He traveled all over the island, and lived among the Ainu for five months. He has illustrated his book with drawings of utensils, houses and landscapes, and with portraits of the people. He believes that the pure Ainu do not number more than 8,000, though the population, including half-breeds, is estimated by the Japanese to be from 15,000 to 17,000.

Mr. Landor made his observations in a scientific manner, taking measurements of both men and women. He found the average height of ten pure Ainu, five men and five women, to be 62½ inches for the men and 58⅜ inches for the women; with the arms outstretched, the men measured 65⅜ inches from finger tip to finger tip, the women 61¼ inches.

He makes quite clear the total dissimilarity between the Ainu and the Mongolian. The eye is Caucasian in its form and setting; the iris is light brown or gray. The complexion is a light reddish brown; the hair is generally black and curly in adults, though in one section of the island men were noticed who had hair and beard of reddish color.

He thus describes the typical face: "When seen full face the forehead is narrow and sharply sloped backward, the cheek bones are prominent, and the nose is hooked, slightly flattened, and broad, with wide, strong nostrils. The mouth is generally large, with thick, firm lips, and the under lip well developed. The space from the nose to the mouth is extremely long, while the chin, which is rather round, is comparatively short and not very prominent. Thus the face has the shape of a short oval. The profile is concave, and the mouth and eyebrows are prominent. . . . . In the supraorbital region the central boss is extremely well marked; also the brow ridges, which, however, are slightly less conspicuous than the central boss. The ears are usually large, flat, and simply developed."

The sense of hearing is extremely acute, as is also that of smell. They know a Japanese from an Englishman by his odor, and yet they do not seem to notice the foul odors of their own persons and dwellings, where filth and vermin prevail.

The Ainu women do the hard work and the men are fond of hunting and riding on their ponies. They always pull a heavy object toward them, rather than push it from them, and they use teeth, feet, and toes to help the fingers, preferring to pull with the teeth rather than the hands, when a load is heavy. In all these movements they are like the anthropoid apes. They show little evidence of emotion. Mr. Landor once made a man "roar" with surprise and pleasure; but he never saw one laugh. They seem to have neither sense of shame nor of fear.

On the whole, Mr. Landor's observations lead him to believe that the Ainu are the most primitive of the northern Asiatic races, and that they may have originated from the same stock as did the northern Europeans.

The Application of Chemistry to Tanning.

BY PROF. SADTLER.

One of the industries in which great changes have been made in the last few years, owing to the introduction of new chemical processes, is the tanning and leather industry. While the tanning of heavy leather has been improved by the widespread introduction of oak and hemlock bark extracts of definite and uniform composition, it is in the tanning of lighter leathers, such as calf and kid, that the greatest advances have been made. For these, the "dongola" tanning and the newer "chrome" or mineral tanning processes have almost entirely displaced older methods. The dongola process is a combination process using gambier, alum, and salt, together, in the same liquor, and following the tanning proper by a treatment of the leather with "fat liquor," or oil emulsified with borax or soda solution.

It is, however, the successful introduction of the mineral tanning processes which is now revolutionizing the manufacture of lighter leathers in America. The process generally in use at present involves treating the skins at first with a weak solution of bichromate of potash, to which sufficient hydrochloric acid is added to liberate the chromic acid. After the skins have taken up a bright yellow color through their entire texture, they are drained and transferred to a bath of hyposulphite of soda, to which some acid is added to liberate sulphurous acid, which reduces the chromic acid to green chrome oxide, while the sulphurous acid is at the same time oxidized to sulphuric acid, which liberates a further portion of sulphurous acid until the whole of the chromic acid is reduced. The leather so produced is of a pale bluish-green color, tough and flexible, and thoroughly resistent to water. Indeed, it is this latter property which distinguishes it from all other forms of leather, as the combination of the hide fiber or coriin with the chromium oxide is apparently more stable than its combination with tannin, and yields less to boiling water. The leather also can be dyed and produced in a variety of colors, but the dyeing must be done before the leather dries, as its water-repellent character is such that once dried it cannot be wetted sufficiently to take up a full color. The process is now carried out at several morocco tanneries on a very large scale, and with perfectly satisfactory results.

Chrome tanning processes involving the use of chrome alum and other salts of the sesquioxide of chromium as the basis of the tanning vat have been used, but apparently the combination does not take place so readily as where the chromium oxide is obtained in *statu nascendi* by reduction from the bichromate under the influence of reducing agents. Basic chromium salts have also been recently proposed as mineral tanning agents, but of their practical success I cannot speak from personal knowledge. That mineral tanned leather has taken a strong hold upon the industry was made evident by the many and fine exhibits of such leather at the recent Chicago exhibition.—*Chem. Tr. Jour.*

The First Photographer.

Under this heading W. H. Harrison, in *Photography*, gives the following summary of the career of the first man to introduce the use of the salts of silver into photography.

The first photographer, Johann Heinrich Schulze—sometimes spelled Schultze—was a professor of medicine in the University of Halle, and he wrote a great number of medical works, most of which are in the British Museum Library. He was born at Colbitz in the Duchy of Magdeburg, May 12, 1687. When at school, and before he was ten years of age, Corvinus, the priest of his native hamlet, was struck with his ability; indeed, one day he found him in the garden studying a Greek Testament. His father was a poor tailor at Colbitz. In 1697 young Schulze was sent to the Royal Pædagogium at the University of Halle to continue his education. In 1701 he began the study of Oriental languages, and in 1704 he was admitted into the University of Halle as a student of medicine; he was trained by Professors Stahl, Richter and Eckebrecht; he, at the same time, gave some attention to antiquarian research and to Rabbinic lore. In 1708 he accepted an appointment as teacher in the school of the university, and worked in it for seven years, at the same time carrying on the study of several Eastern dead languages. He then attracted the attention of Frederick Hoffman, the Boerhaave of Germany, who engaged him to aid him in his literary and medical work. He made so much progress that in two years he took the degree of doctor of medicine, and shortly afterward began to obtain public reputation because of his medical writings. After his marriage in 1720 to a relative of Corvinus, he was appointed professor of anatomy at the University of Altdorf. In 1729 he was appointed professor of Greek, and, later on, that of Arabic. The Prussian government, in 1732, appointed him professor of elocution and antiquities at the University of Halle. In 1738 he was nominated a foreign member of the Academy of Sciences, at St. Petersburg, as successor to Bayer, and in 1737 he was professor of theology at Halle. He died October 10, 1744. Schulze was the first to print an image of an object by the agency of light. In 1727 he poured nitrate of silver upon chalk, proved that its darkening in sunlight was due to light and not to heat; then he printed upon the deposit the image of a piece of string tied round the containing glass. This was the first photograph ever taken in the world. Next he pasted printed matter round the glasses containing the deposits, and photographed words and sentences.

American Coal in Mexico.

The successful opening of the harbor at Tampico by the jetty system, and the connection of that port with the interior by the Mexican Central and Mexican Gulf railways, gives an additional outlet for our coal and coke. The growth of the trade is indicated by the exports of coal to Mexico:

Year ending June 30.	Anthracite, tons.	Bituminous, tons.
1890	4,178	84,997
1891	3,683	122,865
1892	3,631	114,979
1893	28,089	158,139

The collapse in silver, with its violent fluctuations, has, of course, disturbed this trade in common with others, so that exports for the seven months of the current fiscal year have been 85,339 tons, as compared with 101,087 tons in 1892-93, those for January being 18,474 tons, against 23,149 tons in that month last year.

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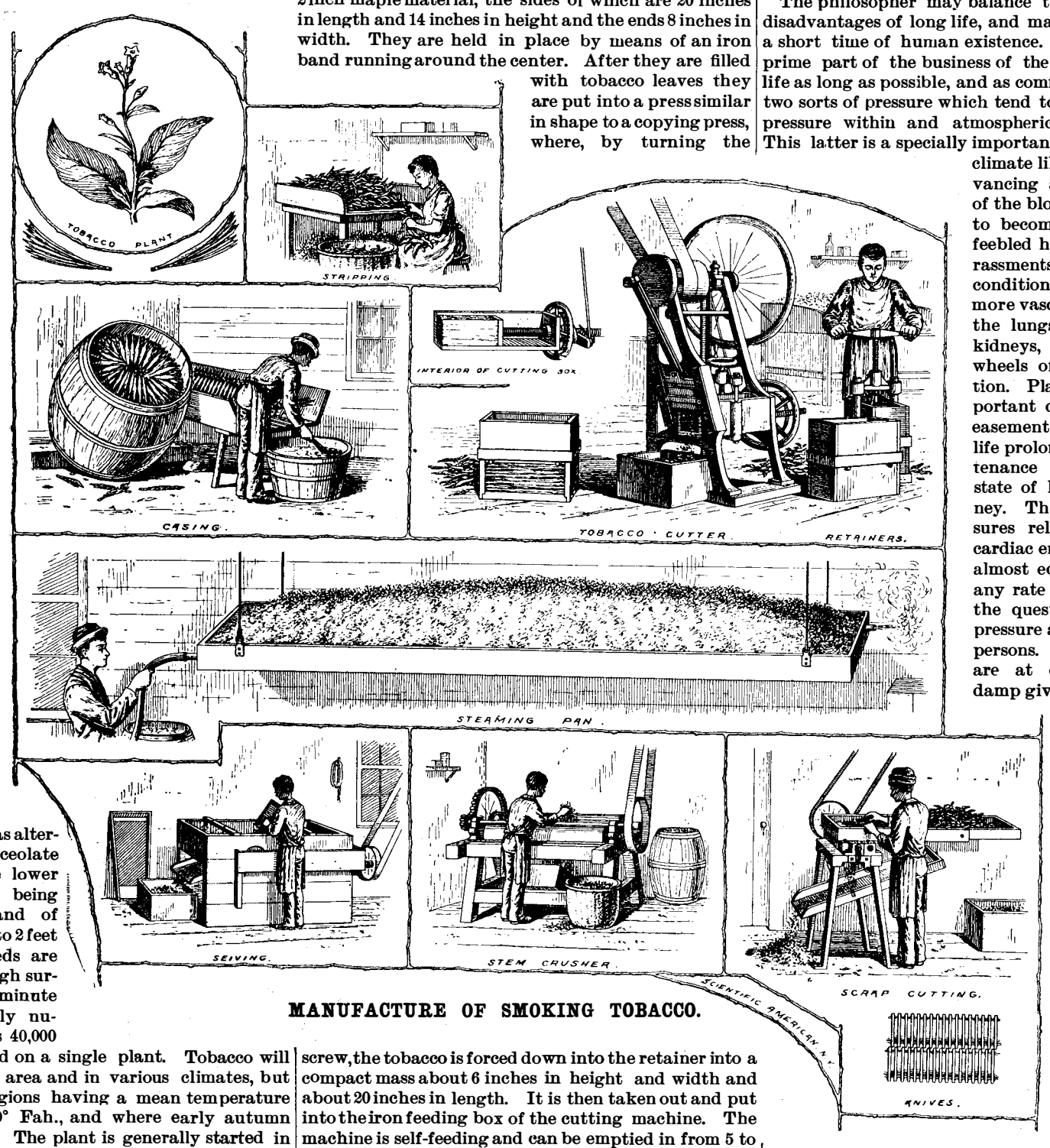
MANUFACTURE OF SMOKING TOBACCO.

Tobacco consists of the leaves of several species of Nicotiana variously prepared for use as a narcotic. While it is principally manufactured for smoking, a large amount is also prepared for chewing and to a more limited extent is taken in the form of snuff. Although the fact has been controverted, there cannot be a doubt that the knowledge of tobacco and its uses came to the rest of the world from America. In November, 1492, a party sent out by Columbus to explore the island of Cuba brought back the information that they had seen people who carried a lighted fire brand to kindle fire and perfumed themselves with certain herbs which they carried along with them. As the continent of America was opened and explored, it became evident that the consumption of tobacco, especially that of smoking, was a universal and immemorial usage, in many cases bound up with the most significant and solemn tribal ceremonies. The tobacco plant was first introduced into Europe in 1558. Jean Nicot, the French embassador to Portugal, sent seeds to the Queen, Catherine de Medici. The services rendered by Nicot in spreading knowledge of the plant have been commemorated in the scientific name of the genus Nicotiana. The chief tobacco States in the United States are Kentucky, Virginia, Ohio, Pennsylvania, Tennessee, North Carolina, Maryland, Connecticut, Missouri, and Wisconsin. The area sown with tobacco in 1880 was about 638,841 acres. The crop, 472,661,157 pounds Smoking tobacco is made principally from the Kentucky and Virginia plants. It is a coarse, rank-growing annual, with a simple unbranched cylindrical stem, which attains a height of 6 feet and upward, terminating in a panicle of pink flowers. It has alternate oblong lanceolate leaves, those at the lower part of the stem being slightly stalked and of large size, reaching to 2 feet in length. The seeds are brown, with a rough surface. They are of a minute size and exceedingly numerous, as many as 40,000 having been counted on a single plant. Tobacco will flourish over a wide area and in various climates, but is best suited for regions having a mean temperature of not less than 40° Fah., and where early autumn frosts do not occur. The plant is generally started in hot beds and transplanted in May. The plants are carefully weeded and the soil frequently stirred with narrow hoes until they show symptoms of flowering. The flowers must not be allowed to form except in the case of a few plants left for seed. To obtain fine and strong leaves the top is broken off the plant. The plants are cut in September, when the leaves have a yellowish tint and droop. They are then hung up on scaffolds in the barns for a few days to wilt and wither in the air, after which they are dried by artificial heat, with a temperature raised gradually up to 170° Fah., the drying being completed in four or five days. The tobacco at this stage is brittle and cannot be handled. The contents of the barn is then left till moist weather occurs, and then, by the admission of atmospheric air, the leaf blades by the moisture become soft and pliant. In this condition the leaves are stripped from the stems and sorted into qualities, such as "lugs," "firsts," and "seconds." These are made up into hands or small bundles of from six to twelve leaves each, and in this condition are ready for fermentation. They are then piled up on the floor to a height of 5 or 6 feet. Within this stack a process of fermentation is set up and the temperature of the mass rises steadily till it reaches about 130° Fah. The pile is taken down from time to time and rebuilt, the tobacco from the top going to the bottom. In from three to five weeks the fermentation is carried out and the leaves have a uniform brown color. It is then ready for shipping. The tobacco is bought by the manufacturer from the broker and comes packed in casks of about 1,500 pounds weight. The hands of tobacco are packed in the casks in a circular form, the upper end of the leaves pointing to the center. The first operation is casing, which dampens the leaves and prepares them for the stripper. An expert is required for this operation, it being necessary to know by dipping the ends what quantity of water is required to moisten the leaves without injury. After dipping they are placed in an upright position in the casing frame and left to drain about an hour, when they are ready for stripping. The stripping is generally done by girls or boys, and is done by taking the ends of the leaves in one hand and with the other drawing out the stem. An expert stripper can remove the stems of about 150 pounds daily. After stripping, the leaves are packed in retainers. They are made of 2 inch maple material, the sides of which are 20 inches in length and 14 inches in height and the ends 8 inches in width. They are held in place by means of an iron band running around the center. After they are filled with tobacco leaves they are put into a press similar in shape to a copying press, where, by turning the screw, the tobacco is forced down into the retainer into a compact mass about 6 inches in height and width and about 20 inches in length. It is then taken out and put into the iron feeding box of the cutting machine. The machine is self-feeding and can be emptied in from 5 to 10 minutes. The tobacco is forced or pushed through the box to the knife by means of a traveling screw. The screw is pushed forward by a feeding arm and a ratchet wheel which connects to an arm of the fly wheel by means of a circular rod, the upper end of which is attached to a regulation slide. At every revolution of the fly wheel, which makes 150 revolutions per minute, a dog which is connected to the feeding arm drops down in between the teeth of the ratchet wheel, at the same time pushing it forward, causing the screw which passes through the hub of the ratchet wheel to move ahead, which in turn forces the tobacco toward the knife. By shifting the regulating slide the knife can make from 50 to 300 cuts to the inch. The feeding box holds from 16 to 18 pounds. The cutting capacity of the machine is about 1,000 pounds daily. The tobacco, after pressing and cutting, is caked and has to be separated. This is done by steaming. A hollow zinc pan, about 15 feet in length and about 5 feet in width, is suspended from the ceiling, about 150 to 200 pounds of tobacco is then placed upon it, and a steam pipe inserted into one end, the steam passing through and escaping out at the other, the heat of which causes the material to curl and loosen. For flavoring or saucing, sugar, licorice, and saltpeter are used. For separating the fine from the coarse tobacco, the material is passed through a number of brass sieves the meshes of which run from 12 to 22 to the inch. The scraps are cut up into a machine having two grooved rollers with cutting edges facing in opposite directions, forming a large number of rotary shears. About 500 pounds daily can be cut on this machine, it making about 125 revolutions per minute. The stem crusher consists of two 305 pound iron rollers, 2 feet in length and 18 inches in diameter, which revolves at the rate of 100 revolutions per minute, crushing the stems, if dry, into fine particles. The tobacco leaves cost the manufacturer from 4 to 15 cents per pound. The revenue required by the government is 6 cents per pound on manufactured goods. From September 1, 1862, to June 30, 1892, 3,956,862,124 pounds of tobacco were raised in the United States. The revenues collected from the same amounted to the sum of $573,757,258.53. The sketches were taken from the plant of G. B. Herbst, Jersey City, N. J.



MANUFACTURE OF SMOKING TOBACCO.

Aids to Longevity.

The philosopher may balance the advantages and disadvantages of long life, and may decide in favor of a short time of human existence. But it is clearly a prime part of the business of the physician to make life as long as possible, and as comfortable. There are two sorts of pressure which tend to shorten life—blood pressure within and atmospheric pressure without. This latter is a specially important factor in a humid climate like our own. In advancing age the circulation of the blood and lymph tends to become slow, and the enfeebled heart finds its embarrassments increased by this condition. Especially do the more vascular organs, such as the lungs, the liver, and the kidneys, put skids on the wheels of the blood circulation. Plainly, then, an important condition of cardiac easement, and therefore of life prolongation, is the maintenance of an uncongested state of lung, liver, and kidney. Thus are internal pressures relieved, and thus is cardiac energy conserved. Of almost equal importance, at any rate in Great Britain, is the question of atmospheric pressure and moisture to aged persons. Situations which are at once low-lying and damp give, of course, a maximum of atmospheric pressure. Such pressure weighs down at a single stroke body, mind, and life. The difference to aged persons between living at the sea level and living five hundred feet above it, between living in a moist atmosphere and living in a dry one, is sometimes quite incalculable. Not seldom life may be lengthened by five or even ten years by living in an atmosphere which is both light and dry. These physiological considerations are commended to the aged and to the physician of the aged. While physiological explorers are busy in the laboratory, clinicians must not imagine that new discoveries can be applied in practice without constant and intelligent effort on their part. Knowledge, like freedom, "filters slowly down," but there is no objection to a little artificial acceleration of the pace.—*Hospital.*

The Navies of England, France and Russia.

The seventh yearly edition of the "Aide Memoire de l'Officier de Marine," the compilers being M. Edouard Durassier, Chef de Bureau in the French Ministry of Marine, and M. Charles Valentino, late of the French Navy, and now a sous chef de bureau in the Ministry of Marine, gives the following statistics of the relative naval strength of France, Russia, and Great Britain:

	France.	Russia.	France and Russia.	Great Britain.
Armored ships	66	55	121	81
Unarmored ships	160	72	232	280
Torpedo boats	230	180	410	155
Officers	2,227	1,573	3,800	2,803
Seamen	41,536	38,000	79,536	42,507

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RECENTLY PATENTED INVENTIONS.

Engineering.

LOCOMOTIVE EXHAUST NOZZLE.—John O'Neill, Plainview, Ill. This nozzle is adapted for ready application on all kinds of locomotives, is always under the full control of the engineer, and is designed to relieve the working parts of the locomotive of any back pressure. The nozzle casing is held on a stand pipe, and has a contracted outlet in which is a revoluble cutoff secured to a shaft, the cutoff being actuated from the reversing shaft of the engine, so that no back pressure will take place in the cylinders, and at the same time the necessary draught will be given in the boiler flues.

Railway Appliances.

SIGNAL AND SWITCHING APPARATUS.—John D. Taylor, Chillicothe, Ohio. This invention provides an electrically controlled and operated mechanism to serve as a block signal system, a switch operator and crossing signal, all controlled by the current, but so arranged as to give the danger signal in case of failure of the current. The improvement consists in the combination of electric motors, semaphore-operating mechanism, controlling magnets, and switch-operating mechanism. The switch mechanism can be applied to transfer switches as well as to derailing switches, and the improvement is applicable at the junction or crossing of any number of roads, it being impossible, with this improvement, to give the right of way to trains on two roads at the same time through carelessness.

SWITCH AND SWITCH OPERATING MECHANISM.—Joseph E. Downer, Allenport, Pa. This is a simple device, applicable to any kind of a train, and providing means whereby a switch may be set from the train, either for the main line or for a siding, while the train is moving, even at a high speed. Centrally of the switch rails is pivoted a shifting block with concave side faces, and there is an operative connection between the rails and the block, while the trip mechanism on the engine or other part of the train has projections adapted to engage the shifting blocks on either of their sides, such mechanism being conveniently operated by one on the train.

Mechanical.

BELT TIGHTENER.—George H. Hanson, Ellsworth, Iowa. According to this improvement a tightening pulley is located at one side of and beyond the adjusting mechanism, so that the pulley may be applied to either the outer or inner face of the belt. The pulley is held on an axle fitted in a socket of the adjusting bar, the axle standing at right angles to the bar, and the latter extending outward some distance beyond the plane of the standards projecting from a base plate. The tightener may be placed at any desired angle to a support.

Agricultural.

HARVESTER.—Bennett Osgood, Pender, Nebraska (Martha J. Osgood, administratrix). This is an improvement in machines which cut, gather, and bind grain, forming it into a shock before discharging it from the machine, the invention providing for the simple construction and automatic operation of the cutting, binding, and bundle carrier devices. The cut grain falls onto a carrier and is taken under a presser hood whose projecting arms gather a sufficient quantity to form a bundle, which is tied by a binder mechanism, when the bundle is moved by sweeps to a bundle carrier and thrown into a shock frame, which, when sufficiently filled to form a shock, is lowered, and the shock passed out in an upright position.

THRASHER AND SEPARATOR.—Daniel S. Geiser, Waynesborough, Pa. This invention relates to machines in which the straw and grain are discharged into revolving screening drums, the construction being simplified and cheapened by dispensing with complicated mechanisms, the improved machine effectively and economically separating the grain and straw. In a revolving inclined drum are internal spiral-edged ribs, while fingers or combs are so arranged and connected with the cylinder of the thrasher that when fed internally with mixed straw and grain the revolving action of the drum moves the straw forward and on the spiral rings, while the grain settles and passes off through the open faces between the ribs to the winnowing devices, which have carrying fingers and separating combs.

SEED PLANTER OR GUANO DISTRIBUTER.—John P. Allen, Sr., Dawson, Ga. This machine delivers cotton seed, corn, peas, etc., and guano or other fine fertilizers, uniformly in drills, and in greater or less quantities, as desired. It is an improvement on a former invention of the same inventor, providing means for the convenient control of the distribution of seed and fertilizer, and for such construction of the covering plows that they will surmount an obstacle met with and automatically return to their normal or covering position. These plows may also be readily thrown out of contact with the ground when desired.

HOG STY AND FEED TROUGH.—Albert Auchly, Montgomery City, Mo. This sty is a walled structure with intermediate partition, there being double folding pendent doors at one side of the partition on the rear wall of the sty, with swinging and folding doors on the other side of the partition, means to retain the doors upwardly folded, and a runway below the doors along the rear of the sty, while connected with the floor is a trough adapted to receive rocking adjustment, affording means for the safe feeding from the same trough of a litter of small pigs at the side of the parent sow, preventing waste of food or the entrance of the pigs within the trough.

COW STALL.—Joseph Ardron, Mandan, North Dakota. This invention provides simple means designed to prevent the fouling of the bedding in cow stalls, a presser piece being arranged to contact with the backbone of the cow when it arches its spine, causing the cow at such times to step backward, thereby preventing the floor or bedding or the animal from becoming fouled.

FEED BOX.—John H. Denison, Maquon, Ill. This box is preferably made of metal, and is divided by a partition into a feeding and a storage compartment, the partition having a gated opening near its bottom, while a lid covers the storage compartment. Within the storage compartment is a screen for automatically screening the grain or feed when necessary.

SPRAY NOZZLE.—Charles Hood, Puyallup, Washmgton. This nozzle is adapted to spray plants, trees, etc., with liquid poison, the device affording an exceedingly fine spray or fog, having more force than the ordinary spray, while the cleaning of the nozzle when stopped up is readily effected. The nozzle has no outside attachments likely to catch on vines or shrubbery, and may readily be converted into a sprinkler.

CHICKEN BROODER.—John C. Nicholls, Blue Mound, Ill. In this brooder fresh air only is supplied to the brood chamber, and the bottom is gently warmed, while a greater portion of the heat comes from above. The brood chamber has a removable bottom covered with sand, so that it may be readily cleaned, and there are runs at each side of the chamber.

Miscellaneous.

FIRE EXTINGUISHER AND ALARM.—James C. Morton, Washington, N. C., and Edward B. Freeman, Norfolk, Va. This is a combination apparatus more particularly adapted for use in connection with lumber driers or kilns, which are, according to this invention, equipped with flood pipes connected with a suitable source of water or steam supply, or both, and with mechanism adapted to open the proper valves in case of fire. The draught or stack flues will be at the same time automatically closed, and an alarm sounded by a whistle or gong.

WINDMILL.—Myron H. Richardson, Windom, Kansas. This is a strong, simple and light machine, designed to afford a great deal of power in proportion to its size. It is readily thrown into and out of gear, in the latter case affording very little resistance to the wind. A governor actuated by the centrifugal force of the main shaft and wheel operates to make the wheel turn at a uniform rate of speed without regard to the force of the wind.

SPIRIT LEVEL.—Erik Olson, Neihart, Montana. According to this invention a disk or wheel is secured to the stock, and around the hub of the disk on opposite sides of the web are cylindrical tubes containing spirit or mercury, and having a bubble to indicate on a graduation on a ring held against the corresponding face of the web. The graduation on each of the rings is formed on concentric circles, the lower half indicating degrees and subdivisions, and the upper half bevels, cuts, and pitches, corresponding to the degree indicated by the bubble on changing the position of the stock.

HOOK FOR MINER'S BUCKETS, ETC.—George W. McMillan, Hurleton, Cal. The shank of this hook has a spring-controlled tongue adapted for locking engagement with the hook, while a latch pivoted to and pendent from the tongue is in constant engagement with the hook, serving to maintain the tongue in locked or closed position, and protecting the spring of the tongue. Should a bucket carried by the hook strike an obstruction, the bail would only be forced into better locking engagement with the hook. The device is very simple, strong and inexpensive.

WIRE REEL.—John A. List, Bartelso, Ill. This is a simple form of reel for mounting on a wagon or other vehicle, for winding or unreeling wire in the construction of a fence, and its construction is such that the wire may, by means of a guide arm, and without possible injury to the operator, be directed across the face of the reel to cause it to wind at either end or at the center of the reel, as required.

ACCOUNT KEEPING APPARATUS.—Samuel H. Boylan, Armour, South Dakota. This apparatus is designed to obviate the necessity of keeping the ordinary account books, as day-book, ledger, etc., providing instead a convenient method of keeping original entries upon tickets in envelopes, and summarized on the envelopes, to be filed for ready reference. The apparatus provides a two-part case, with removable cover and body portion open at one end, spring catches securing the parts together, and there being in the body portion guide rails, on which slides a follower having flanges or guides, by means of which the envelopes and tickets may be readily kept in order, but be always accessible.

EASEL.—Hattie F. Beecher, Port Townsend, Washington. This device may be used as a drawing table, but is especially adapted for workers in water colors. The table proper may be adjusted at any desired angle, so that the colors applied will flow with greater or less rapidity, and the table is also adjustable vertically, while the pallets and brush holders are so connected with it as to be simultaneously adjusted, as required for the convenience of the artist, whether sitting or standing. The pallets and brush holders are so mounted on the table supports as to be adapted to revolve, thus being always in convenient proximity to the table and the artist.

CURTAIN.—Joseph Darling, Baldwin, Pa. Combined with the roller, operating cords and guides, is a bracket having a main plate at the inner ends of which are upwardly and downwardly projecting arms to which the operating cord is connected, and having at its outward end a lug with a seat for the roller stud, and devices for locking the stud in the seat. The construction and arrangement of parts permits of the extension of the curtain outwardly beyond the operating cords, to fully cover the window, a double crank lever also enabling the operating cord to exert leverage to sustain the bracket and curtain in position.

PORTABLE FOLDING SEAT.—James R. R. Morford, La Harpe, Ill. This is a device which, when not needed, may be slid as an envelope upon a folded umbrella, in which way it may be carried about, affording a temporary seat for one desiring to rest for a time in the open air. It consists of a tapered hollow standard, to the top edge of which are hinged seat bars adapted to fold across each other and project beyond the standard, there being a spring catch adapted to interlock with one seat bar.

LAMP.—Franz Gedies and Carl Schunke, Berlin, Germany. This is an adjustable lamp adapted to be readily brought into any desired convenient position to facilitate working or reading. The lamp-carrying tubular arm of a vertical standard adapted to be readily clamped to a table or other support has a longitudinal projecting rod, on the outer end of which is a vertically adjustable arm to which is secured the base of the lamp, whereby the several adjustments are readily effected.

ICE CREAM FREEZER.—James S. Stidham, Floyd, Texas. According to this improvement the refrigerating box, arranged to be revolved by a crank, has in its several sides openings to receive elongated cream cups, the latter being so arranged as to form a lining within the ice box, and so that every cup will be exposed throughout its length to the action of the ice. After the cream or ices are frozen they may be preserved for quite a time without replenishing the ice.

SASH BALANCE.—Valentine Schirmer, New York City. This improvement is adapted for window frames of different dimensions, being capable of convenient adjustment for increase in tensional force of its spring, and adapted to receive a locking adjustment to retain the coiled spring from relaxing when the balance is prepared to receive and sustain a window sash. A novel mechanism is provided to permit the free introduction and removal of the sash, and effect a working connection between the sash and counterbalancing devices. With this attachment no chains, pulleys, or weights are needed, and a sash fastener is not required, as the sash may be readily locked in any desired position. The sash may also be arranged to swing inwardly, to facilitate cleaning.

SURGICAL CHAIR.—Oskar Baruch, Berlin, Germany. The seat of this chair has an articulated connection with the frame, to be capable of up and down movement, while the back is supported on the upper part of the frame and slides longitudinally, being capable of assuming various angular positions in relation to the seat. The several parts are conveniently adjustable, so that the patient may be placed in any required position for the surgical operation.

FOOT REST FOR BICYCLES.—Milton W. Smith, Long Island City, N. Y. A toothed plate is, according to this invention, fastened to a clamp which is vertically adjustable on the bicycle fork, while a swinging arm having a hub journaled on the face of the toothed plate is provided with teeth to engage the teeth of the plate, there being means for fastening the hub to the toothed plate and a foot rest on the outer end of the arm. The rest may be adjusted vertically in the usual way, and may also be adjusted to and from the rider, to bring it into desired position for an easy rest.

DESIGN FOR DOOR PULL, ETC.—Charles Sotscheck, New York City. A stem-like figure simulating an oak leaf projects from each end of this plate, and the stem-like figures are also entwined with coils, the flat plate of the pull having at its side edges scroll-like figures.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

A HISTORY OF MATHEMATICS. By Florian Cajori. New York and London: Macmillan & Co. 1894. Pp. xiv, 422. Price $3.50.

We have nothing but commendation to bestow upon Professor Cajori's history. On the title page he gives a quotation from Professor Glaisher to the effect that no subject loses more than mathematics by any attempt to disassociate it from its history. The science in itself often seems dry, but when its history is brought together and put into the excellent shape in which we find it in the present work, what seems to the layman a dry skeleton is clothed with a most attractive form. The work is naturally largely biographical, telling of the work of each investigator in turn, and of their various disputes and counter theories.

A POCKET BOOK OF MARINE ENGINEERING RULES AND TABLES. By A. E. Seaton and H. M. Rounthwaite. London: Charles Griffin & Company. New York: D. Van Nostrand Company. 1894. Price $3.

The title of this book, which we have given somewhat fully, explains sufficiently its scope. When we state that it is very attractively printed, illustrated as required, contains an index and excellent table of contents, and is elucidated by 127 separate tables, we think enough has been said to show how valuable it will be found by the working engineer. It is bound in flexible leather with rounded corners, so as to present a very workmanlike appearance, suggesting utility to the practical marine engineer.

THE WORLD'S CONGRESS OF RELIGIONS. Edited by C. M. Stevens, with an introduction and review by Rev. H. W. Thomas. Chicago: Laird & Lee. 1894. Pp. 363. Price 50 cents.

This book claims to be a complete and concise history of the world's congress of religions held at Chicago. It contains extracts from the various addresses delivered there and contains portraits of some of the participants.

ELEMENTS OF SYNTHETIC SOLID GEOMETRY. By N. F. Dupuis. New York and London: Macmillan & Co. 1893. Pp. xii, 239. Price $1.60.

This exceedingly well treated and well made book is intended by the author as a continuation or sequel to his work on plane geometry.

GUIDE TO THE STUDY OF COMMON PLANTS: AN INTRODUCTION TO BOTANY. By Volney M. Spalding. Boston: D. C. Heath & Co. 1894. Pp. xxiii, 246. Price 85 cents.

This excellent and interesting work is designed for the use of advanced schools. It treats of modern botany by modern methods, so that a peculiar life and aspect of reality is given to the subjects, the work reading not at all like the old type, dry botanies, but by suggestion and the use of the induction method awakening the interest of the students. It covers very interesting ground and is so written that it can be read almost as a literary work, while it may also be employed as a text book pure and simple.

A TREATISE ON THE KINETIC THEORY OF GASES. By Henry William Watson. Oxford: Clarendon Press. 1893. Pp. xiv, 87. Price $1. No index.

The author states that his object in his treatise is to make the existing state of the theory more widely known, in the hope that mathematicians may be induced to turn their attention to the theory, and thus remove, if possible, the obstructions remaining in the way of its completed establishment. The work is very mathematical in treatment and will prove a valuable contribution to this branch of physics.

HELICAL GEARS: A PRACTICAL TREATISE. By a Foreman Pattern Maker. New York: Macmillan & Co. 1894. Pp. xv, 127. Price $2.

The author believes that this is the first work on the subject which has ever yet appeared written by one who claims to be a pattern maker. It is fully illustrated by clear and demonstrative cuts, so that an exceedingly practical aspect is given to the treatise. It forms a valuable addition to the literature of foundry and machine work, which has received so much attention during the last few years.

PRACTICAL WORK IN HEAT. By W. G. Woollcombe, M.A. Oxford: Clarendon Press. New York: Macmillan & Co. 1893. 12mo. Pp. 61. Illustrated. Cloth. Price $1.

A college text book using mathematics freely. The description of experiments, to which the entire work is devoted, is very clear, and doubtless the book will prove of value for use in connection with any standard work on physics.

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APRIL, 1894.—(No. 102.)

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(5927) Littleton asks the correct solution to "the reason that a top stands up while spinning." A. Gyroscopic force is the cause. A rotating body always tends to rotate about the axis giving the highest moment of inertia. The mathematical investigation is difficult. If you consider that a high moment of inertia means high centrifugal force, you can reach some conception of the subject.

(5928) S. S. G. asks what quicksilver is and what it is used for. A. Quicksilver is a metal that is fluid at ordinary temperatures. It is solid and ductile when frozen. 2. And is there any fluid that can be permanently magnetized? A. No. 3. How can I make a good battery out of carbon sticks, trimmings of the electric light? A. If the carbons are copper, the copper should be removed by means of nitric acid, and the carbons washed and dried. The upper ends of the carbons are to be heated sufficiently to melt paraffine. Paraffine is applied to the ends and allowed to saturate them for a distance of about an inch. Upon these saturated ends of the carbons are cast lead caps. Use about 8 or 10 rods to each battery and connect the carbons to the wire. Insert the rods in a glass or glazed earthenware vessel. They should be arranged in the outer part of the vessel, and in the center of the series of carbon rods insert an amalgamated zinc rod or plate. The cell used in this battery is the bichromate formed by making a saturated solution of bichromate of soda in water, and slowly adding to it one-fifth its weight of commercial sulphuric acid. It is used in the manufacturing of thermometers and barometers, in silvering looking glasses, in amalgamating precious metals in mining. Also for mercurial air pumps and in batteries. Its salts are used in medicine and in the arts. 4. What makes a compass needle stand north and south? A. The earth may be considered a great magnet, having north and south poles. It acts upon a magnetized needle in the same manner as any magnet. 5. What would be a good work for me to get on electrometallurgy? "Electro-Deposition of Metals," by A. W. Watt, price $3.50.

(5929) L. D. G. asks: 1. What is the smallest size boiler that will, in the most economical way and without noise, raise the temperature of 40,000 gallons of sea water from about 40° to 70° and keep it at that temperature, notwithstanding 10,000 gallons of water are pumped in and ont every twenty-four hours? The sides and bottom of the tank to be bricked and cemented, and the whole inclosed in a brick building. A. You will require a twenty horse power boiler to heat the 40,000 gallons in a day or a 10 horse power boiler to heat in two days and keepnp the supply. The only way without noise is to connect the top and bottom of the boiler directly to the tank in the same manner as a kitchen hot water boiler, and heat by circulating the water. 2. How does aluminum rank as an electrical conductor? A. The electric conductivity of aluminum is 0·51, copper 1·00, or 0·33, silver 1·00. 3. Can either temporary or permanent magnet be made out of aluminum? If not, what percentage of iron or steel would be necessary to use with it? A. Aluminum is very feebly magnetic. Have no data as to alloys. It will probably decrease the efficiency of iron or steel in magnetic force. 4. Does electricity travel on the exterior or center of a conductor? A. Electricity is supposed to travel on the surface of metals. 5. Is there any difference in the resistance between bare copper wire and either annealed iron, lead, or steel wire, each of the last three to be heavily plated, and of the same size as the copper wire? If so, how do they compare, also in cost? A. There is probably no perceptible difference in the conductivity of a solid copper wire and any other metal heavily plated with copper. We judge that the plated wire will cost more than solid copper wire. 6. Where can I get a catalogue of amateurs' chemical apparatus? A. Address Eimer & Amend, New York, for chemical apparatus.

(5930) W. D. F. asks: 1. Is a license that has been issued to an engineer in Missouri good for this State? A. No, unless issued by a United States inspector, when it is good for the district. 2. Where shall I apply to obtain an engineer's license, either first or second class, and what are the necessary requisites? A. If a marine license, apply to United States inspector at Chicago. If for stationary engine, apply to local inspectors where inspection laws are in force. Otherwise no license is required. 3. Do I need a different license to run a locomotive from a steamboat, or to run a stationary engine? A. Where a license is required, the kind of engine is specified. 4. What are the best books for an engineer to study for good solid information on steam? A. Among the many excellent works on steam engineering in our catalogue, which we mail free, are "Locomotive Engine Running and Management," by Sinclair, $2; "Locomotive Catechism," by Grimshaw $2; A larger catechism, by Forney, $5; "Stationary Engine Driving," by Reynolds, $1.75; "The Modern Steam Engine," by Colyer, $5; "The Triple Expansion Engine," by Wingate, $1; "Marine Engines, Boilers, and Propellers," by Edwards, $5; "Manual of Marine Engineering," by Seaton, $5, by mail. 5. Is the examination for a second class license difficult, that is, will it involve technical points not easily understood by experience and not book knowledge? A. You will require some experience, together with a study of the catechism and familiarity with engineering names, to give you a passable license.

(5931) R. W. asks: 1. Will a tank of water empty as fast through a simple hole in the bottom of the tank one inch in diameter as through another hole in bottom of the same diameter with 20 feet of pipe attached perpendicularly of exactly the same area as hole? A. The tank will empty fastest through the 1 inch pipe by the force of gravity through the additional head. 2. Will a basin at the top of a perpendicular pipe with only ½ inch opening into 2 inch pipe discharge as quickly as if the discharge pipe was all ½ inch, both pipes open at bottom? A. The basin will empty fastest through the ½ inch pipe for the above reason. The stream is broken in the 2 inch pipe and has very little pull due to gravity as in the solid column of the ½ inch pipe. 3. Will a tank empty more quickly through the same opening 1 foot from the ground than if it was raised 6 feet, free discharge in both cases? A. The difference in gravity is too small in a difference of feet, in elevation to be observed, although there is a difference in favor of the lower position.

(5932) C. A. W. writes: 1. I have a shunt-wound dynamo which gives 10 volts and 43 amperes, which it was built for. Can I reduce it in any way so it can be used for nickel plating? I mean, connect it with bath, so I can reduce the current down to say 1 to 4 volts, and still have current enough to nickel plate with in a bath of about 20 gallons. I have tried it with reduced speed, but the minute I connect the bath up the current runs down to nothing. A. It is possible by changing the strength of your field to plate small articles with your dynamo; but it will be at a great disadvantage. It should be rewound. If you try to use it without rewinding, work your system by ampere meter, not by volt meter. 2. What voltage and current is required for nickel plating? A. At starting, use 0·1 ampere per square inch of electrode, at 5 volts. Reduce 0·02 ampere at 2 volts. 3. What battery would plate well? A. A large plunge, or, better, porous cup bichromate battery. For plating dynamo, we refer you to our SUPPLEMENT, Nos. 720 and 793.

(5933) R. W. says: Will you kindly print in your "Notes and Queries" column a formula for writing fluid? A. 1. Black Writing Fluid.—Digest ¼ pound logwood in fine chips for twelve hours in 3 pints boiling water, then simmer down gently to 1 quart, carefully avoiding dust, grease, and smoke. When cold, decant the decoction and dissolve in it by agitation 20 grains yellow chromate of potash; it will then be fit for use. 2. Blue Writing Fluid (Mohr).—Pure Prussian blue, 9 parts; oxalic acid, 1½ parts. Triturate to a smooth paste with alittle water. Dilnte with sufficient soft water to make it fluid.

(5934) W. C. V. asks: 1. Will the electric motors described in No. 641, SCIENTIFIC AMERICAN SUPPLEMENT, develop as much power from a given battery as any kind of motor manufactured? A. No; this is designed as a simply constructed motor, and is not supposed to give the highest efficiency. 2. Do the motors that have compound widening develop greater power than others? A. The efficiency of a motor is independent of this. 3. Is it more economical to use a primary battery directly with a motor or to charge a secondary battery with a primary and then use the secondary battery with the motor where it is only necessary to use a motor a few hours at a time? A. It is better to use the primary battery directly.

(5935) M. S. P. asks: Will two cells of storage battery be sufficient to run the motor described in SUPPLEMENT, No. 641, each cell having six plates, 8 by 10; also if the same cells can be formed and charged by using 4 cells of gravity battery to one of storage battery? A. Yes. For charging use at least 5 gravity cells. The charging with them will be very slow.

(5936) G. F. H. asks: Why is it that the wire with which an electric light (incandescent) is suspended is made up of two insulated bunches of very fine wires, of about 15 wires in a bunch? Would not two solid wires of same size as each bunch be just as good? A. The construction is adopted to secure flexibility. Solid wires would be just as good otherwise.

(5937) A. E. S. writes: 1. In the office where I work there is a slow-moving belt, which when running is charged with electricity, so that I can draw sparks from it with my knuckles. I out of curiosity placed the bulb of an incandescent electric light near it. To my surprise I had the northern lights in miniature, but when I placed the light back in the socket it immediately burned out; still, when placed back near the belt, the same phenomena would occur. A. The phenomena displayed by the incandescent lamp have no connection with the presence or absence of the carbon. 2. If black is the absence of color, what is the color of a small quantity of air? A. Black is better defined as the absence of light. Air is without color or transparent in small quantity.

(5938) R. E. W. asks: 1. Will cotton-covered wire (No. 34) answer nearly as well as silk-covered for a small induction cell? A. Yes. 2. Would best quality tool steel be fine enough to make the compound magnet in Bell telephone receiver? A. Tool steel will answer very well. Shear steel is better. 3. I have a Kidder magneto machine which does not generate as powerful a current as when it was new. Is there any way to increase the current? A. Better send the machine to the manufacturers. Without a personal examination of it we will be unable to suggest any remedy for the difficulty. 4. Will No. 12 galvanized iron wire be the right kind for a two or three mile telephone line? A. Yes.

TO INVENTORS.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

March 27, 1894,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Acid, making concentrated nitric, H. A. Frasch.. 517,098
Adding apparatus, K. E. Wiberg.. 517,319
Adding machine, W. K. Nichols.. 517,291
Adding, subtracting, and recording machine, W. W. Hopkins.. 517,383
Air brake apparatus, J. B. Stewart.. 517,250
Air forcing apparatus, B. F. Evans.. 517,039
Anchor box, H. A. Goetz.. 517,186
Annealing and hardening steel rods or wire, C. W. Bildt.. 517,020
Apparel hanger, wearing, G. Buch.. 517,325
Asphalt rock, machine for crushing and grinding, J. H. Tabler.. 517,311
Awning, C. Leclercq.. 517,346
Axle, vehicle, G. H. Westinghouse.. 517,203
Baby walker, Bradish & Wilcox.. 517,403
Bag. See Traveling bag.
Bank, pocket savings, N. A. Shigon.. 517,175
Barometer, compound tri-liquid, O. H. Woodworth.. 517,089
Barrel filler, G. R. Babbitt.. 517,136
Barrel washer, F. E. Anderson.. 517,091
Barrels to stocks, detachably securing, A. Burgess.. 517,024
Batteries, apparatus for supplying or removing storage, W. E. Worthen.. 517,134
Battery. See Secondary battery.
Bearing, vehicle ball, D. Pettit.. 517,235
Bed, combination folding, E. E. Murphy.. 517, 7
Bedstead, H. Karp.. 517,280
Beer, method of and apparatus for extracting air from, J. Hunt.. 517,161
Bell, E. D. Rockwell.. 517,305
Bell, bicycle, R. H. Charles.. 517,026
Bench dog, C. A. Wayland.. 517,317
Bicycle adjusting device, J. H. Prince.. 517,294
Bicycle speed gearing, A. D. Pringle.. 517,063
Bicycles, etc., driving mechanism for, Allen & Parker.. 517,373
Blower or force pump, rotary pressure, J. S. Godfrey.. 517,273
Boiler. See Steam boiler.
Boiler tubes, etc., protecting ends of, H. Wigge.. 517,372
Bolt cutter, M. D. Luehrs.. 517,294
Book, check, I. B. Alter.. 517,323
Book, duplicating check, J. Oldfield.. 517,359
Book support, C. L. Work.. 517,255
Book, wall, J. B. Nash.. 517,123
Boot or shoe stretcher, L. B. Cobb.. 517,210
Box. See Bread or cake box.
Brake. See Car brake.
Brake-actuating mechanism, T. Conway.. 517,112
Bread or cake box, J. M. Wheat.. 517,085
Bubble blower, P. D. Horton.. 517,118
Bung closure, E. Hazlehurst.. 517,160
Burner. See Hydrocarbon burner. Oil burner. Vapor burner.
Cable conveyers, etc., coupling for, M. Garland.. 517,338
Calculating apparatus, P. Soulier.. 517,308
Caliper gauge, C. E. Billings.. 517,208
Calipers, J. Randa.. 517,066
Calipers, micrometer, J. D. Sloane.. 517,073
Camera tripod or support, E. W. Perry, Jr.. 517,360
Can opener, G. L. Donovan.. 517,268
Canceling machine, card, A. A. Low.. 517,051
Cane fabrics, device for weaving diagonal strands into, D. E. Warfield.. 517,082
Cane, umbrella, R. Waples, Jr.. 517,315
Canteen, M. Lara.. 517,108
Car brake, L. H. Cole.. 517,212
Car brake adjuster, J. W. Winters.. 517,088
Car brake staff ratchet, A. D. Gerbig.. 517,405
Car buffing mechanism, H. C. Buhoup.. 517,378
Car coupling, J. D. Locke.. 517,389
Car coupling, C. W. Patton.. 517,059
Car coupling, A. W. Van Dorston.. 517,178, 517,179
Car draught rigging, A. E. Mitchell.. 517,145, 517,146
Car, mail or express, W. D. Patterson.. 517,234
Car safety guard, open, W. H. Hart.. 517,339
Car sanding device, C. E. Holbert.. 517,044
Carburetor, J. W. Lambert.. 517,344
Carrier. See Elevated carrier.
Carrier apparatus, J. R. Pollock.. 517,292
Case. See Packing case. Show case.
Casks, pitching, L. Wagner.. 517,400
Casting crucible steel ingots, E. Smith.. 517,197
Casting machine, type, H. Heinebach.. 517,340
Castings, mould for making, N. D. Bailey.. 517,205
Centrifugal separator, C. H. Scharar.. 517,363
Chair. See Hanging or swinging chair.
Chair brace, D. L. Trexler.. 517,313
Check book, W. R. Moore.. 517,121
Chimney top, ventilated, J. F. Spivey.. 517,309
Circuit closer, C. E. Allen.. 517,401
Clamp. See Hose coupling clamp. Testing machine clamp.
Coffee making machine, List & Smith.. 517,283
Coin receiving apparatus, C. C. Clawson.. 517,094
Coin receptacle, H. Russell.. 517,071
Collar and hame, horse, D. K. Bill.. 517,021
Commode, D. H. Murphy (r).. 11,410
Compass deviations, apparatus for determining, correcting, or compensating, C. T. E. Clausen. 517,029
Conduit, subterranean, F. Lang.. 517,345
Core box, G. A. Lambert.. 517,387
Corn cribbing machine, L. M. Millen.. 517,355
Corn cutting machine, M. L. Hydorn.. 517,143
Corset stiffener, J. Wolff.. 517,132
Coupling. See Car coupling. Hose coupling.
Cradle, W. H. Meekins.. 517,286
Crane, overhead traveling, G. A. True.. 517,078
Crate, knockdown, S. F. Sherman.. 517,413
Cuff fastener, J. V. Washburne.. 517,084
Cultivator, E. R. Maine.. 517,227
Cultivator, O. L. Neisler.. 517,289
Cultivator, J. W. Norton.. 517,231
Curl, pin, K. G. Lambert.. 517,107
Curry comb, J. R. Bloser.. 517,259
Cutter. See Bolt cutter. Meat cutter.
Dead centers, device for overcoming, C. M. Currey.. 517,264
Delivering goods, apparatus for automatically, A. F. Martel.. 517,412
Dentia engine head, A. J. Harris.. 517,218
Dental handpiece angle attachment, R. G. Stanbrough.. 517,248, 517,249
Dental plates, manufacturing, G. A. Tompkins.. 517,151
Depurator, E. H. Gollings.. 517,274
Diamond setting, F. P. D'Arcy.. 517,265
Door fastener, T. G. Selleck.. 517,173
Door hanger, R. G. Davison.. 517,213
Dovetailing machine, H. Farchmin.. 517,326
Drilling machine, L. Reichert.. 517,298
Driving gear, T. C. Robinson, Jr.. 517,303
Dumbwaiters, electrical appliance for, J. H. Roberts.. 517,169
Dynamite and making same, Rochester & McArthur.. 517,396
Elbow, metal covered, E. T. Greenfield.. 517,276
Electric calling apparatus, D. H. Rice.. 517,299
Electric elevator, F. E. Herdman (r).. 11,408
Electric heater, L. B. Rowley.. 517,170
Electric motor or dynamo-electric machine, J. W. Henderson.. 517,105
Electric switch, J. S. Gibbs.. 517,100
Electrical apparatus, safety cut-out for, Lemp & Wightman.. 517,120
Electrical indicator, A. E. Kennelly.. 517,163
Electrical keyboard, C. E. Allen.. 517,402
Electrically-operated elevator, F. E. Herdman (r).. 11,409
Elevated carrier, G. W. Keen.. 517,343
Elevator. See Electric elevator.
Elevator gate-operating device, G. C. Hawkins.. 517,117
Elliptical spring, E. & J. J. Laass.. 517,106
Engine. See Gas engine.
Eraser, slate or blackboard, D. E. Dempsey.. 517,034
Exhibiting machine, combined card and dice, J. J. Watson.. 517,316
Extension key, A. A. Dovey.. 517,038
Extractor. See Stump extractor.
Fan, electric ventilating, C. W. De Mott.. 517,214
Fence machine, band, E. Warner.. 517,252
Fence post, A. Stoner.. 517,200
Fence, wire, S. C. Bowen.. 517,209
Fencing wire, G. C. Wright.. 517,256
Filter, J. Roger.. 517,240
Fire escape, Elieson & Pellas.. 517,335
Fire escape or lifter, W. Wellens.. 517,318
Fire extinguisher, D. F. Prosser.. 517,394
Fire kindler, P. Peschong.. 517,060
Folding machine, W. Mendham.. 517,054
Fruit picker, W. H. Haw.. 517,041
Fur from pelts, machine for cutting, C. E. Sackett.. 517,397
Furnace. See Smoke consuming furnace.
Furnace grate, boiler, H. C. Wiggins.. 517,130
Furnace or other flue, still, Chamberlain & Agan.. 517,404
Furnace, traveling grate, F. H. Richards.. 517,067
Furniture, device for fastening slip covers on upholstered, H. Seber.. 517,306
Furniture, office, W. J. McGrath.. 517,122
Gauge. See Caliper gauge. Ring gauge.
Galvanometer, E. G. Willyoung.. 517,253
Game apparatus, E. L. Coffin.. 517,262
Game machine, disk-operated, J. A. Hunt.. 517,046
Game of curling, device for playing the, J. B. Hamilton.. 517,103
Garbage burning apparatus, W. Risley.. 517,301
Garbage crematory, McKay & Delanoy.. 517,288
Garment supporter, W. C. Hoyt.. 517,278
Gas engine, R. Thayer.. 517,077
Gas generator, H. F. Smith.. 517,398
Gas machine, hydrogen, H. R. Pomeroy.. 517,062
Gas, manufacturing, G. M. Westman.. 517,202
Gas meter, H. H. Sprague.. 517,368
Gas meters, etc., register for, H. B. Goodwin.. 517,406
Gas producer, E. J. Duff.. 517,271
Gasometer, W. Wood.. 517,254
Gate, A. Cronkhite.. 517,331
Gate, Russell & Mattoon.. 517,070
Gate, S. J. Smith.. 517,366
Generator. See Gas generator.
Glass bottles, apparatus for manufacturing, H. M. Ashley.. 517,016
Glass finishing machine, A. J. Nellis.. 517,358
Governor, marine engine, J. W. Winters.. 517,087
Grain shocking machine, R. Connell.. 517,095
Grille, R. T. Bertelsen.. 517,207
Guide and fish plate, combined, H. W. Cramer.. 517,330
Gun lock, breakdown, J. Conner.. 517,032
Hair curler, S. K. Mathews.. 517,350
Hammer, steam, T. M. Shearer.. 517,150
Handles and covers to vessels, attaching, G. W. Niedringhaus.. 517,230
Hanger. See Apparel hanger. Doorhanger. Picture hanger.
Hanging or swinging chair, S. F. Purington.. 517,296
Harrow, A. Brocksch midt.. 517,137
Harrow, revolving, S. Shoemaker.. 517,365
Harrow, track, H. Baker.. 517,206
Harvester, cotton, G. Lispenard.. 517,050, 517,409
Harvesting implement, hay, Smith & Lloyd.. 517,399
Hat bodies with hair, machine for covering, P. P. Aries.. 517,257
Hay rake, B. F. Smith.. 517,246
Hay stacker, J. L. Funkhauser.. 517,099
Headlight, W. Prescott.. 517,237
Heater. See Electric heater.
Heating and cooking device, J. Allingham.. 517,321
Heating system, R. M. Dixon.. 517,035
Heel, A. P. Gotham.. 517,157
Hinge, J. Nichols.. 517,124
Hobby horse, R. A. Horning.. 517,142
Hog trough, C. F. Haigler.. 517,101
Hook See Check hook.
Hook, J. D. Kellogg.. 517,221
Horseshoe, A. W. Smith.. 517,176
Hose coupling, J. M. Prior.. 517,192
Hose coupling clamp, F. D. Taylor.. 517,128
Hose cutting and mounting machine, Nolan & Connell.. 517,057
Hub, wheel, T. S. Field.. 517,216
Hub, wheel, I. N. Rothrock.. 517,241
Humidifier, J. Taylor.. 517,310
Hydrant, J. H. Pierce.. 517,061
Hydrocarbon burner, D. M. Somers.. 517,247
Ice cream freezer, C. H. A. Gerding.. 517 114
Indicator. See Electrical indicator.
Ink feeder, M. J. Dolphin.. 517,036
Ink making device, Wexler & Nienstaedt.. 517,371
Inkstand, C. E. Jewell.. 517,284
Ironing machine, garment, W. Choen.. 517,328
Jar fastener, fruit, N. H. Long.. 517,410
Jar rack or holder, fruit, A. F. Frost.. 517,380
Key. See Extension key.
Knitting machines, stopping mechanism for circular, H. A. Houseman.. 517,045
Ladder, aerial, J. D. Alexander.. 517,320
Ladder, fire, R. Brayton.. 517,375
Ladle support, L. L. Powell.. 517,293
Lamp, J. U. Pomeroy.. 517,361
Lamp, carbureting gas, A. Kitson.. 517,386
Lamp, electric, F. C. Rockwell.. 517,069
Lamp electrode, arc, S. Heimann.. 517,042
Lamp, incandescent electric, Ashwell & Tuttle.. 517,017
Land presser, C. C. Maxwell.. 517,352
Last, Mobbs & Lewis.. 517,165
Latch, M. S. Millard.. 517,353
Lifting or hoisting tool, D. Kirkbride.. 517,281
Locomotive, W. E. Worthen.. 517,133
Log carrier cushion, F. O. Kilgore.. 577,222
Loom, W. F. Draper.. 517,269
Loom shedding mechanism, C. H. Thomas.. 517,129
Loom, slat and wire fabric, Parks & Mollart.. 517,058
Lounge or couch, folding, T. Q. Hall.. 517,102
Lubricator, C. A. Delaney.. 517,266
Lubricator, J. B. Purvis.. 517,127
Lubricator, C. H. Ridsdale.. 517,300
Lumber jack, C. D. Clarke.. 517,211
Lumber trimmings for boxes, etc., preparing, A. T. Linderman.. 517,348
Measure, tailor's adjustable, W. Veitch.. 517,079
Measuring instrument, electrical, R. M. Hunter.. 517,162
Meat chopping machine, W. Scheffel.. 517,148
Meat cutter, C. Broeg.. 517,377
Metal sheets, machine for joining and rolling, W. S. Grafton.. 517,116
Metal tapping or drilling machine, T. I. Browne.. 517,023
Meter. See Gas meter.
Milk inspecting apparatus, W. G. Spence.. 517,367
Mill. See Rolling mill. Windmill.
Mill, R. Harris.. 517,104
Milling machine, E. Meyers.. 517,287
Mirror frame, J. F. Wilmot.. 517,131
Mixing machine, R. Hartmann.. 517,158, 517,159

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Mouldings, corner piece for room, A. Simon ... 517,307
Mop wringer and pail, A. H. Ramey ... 517,065
Motor. See Electric motor.
Musical instrument, W. A. Seifert ... 517,196
Nut lock, P. E. Bourgeois ... 517,022
Nut lock, E. S. Carpenter ... 517,185
Nut lock, J. D. Tynes ... 517,370
Oil burner, C. A. Holdridge ... 517,341
Oil burner, crude, M. Lynch ... 517,411
Oiler for elevator guides, automatic, W. J. Ferguson ... 517,272
Ordnance, automatically-operated breech mechanism for, Noble & Murray ... 517,391
Oven, bake, J. J. Pfenninger ... 517,125
Oven, baker's, F. Stolz ... 514,251
Packing case, D. F. Griffiths ... 517,407
Paper making machine, G. Lind ... 517,109
Paper pulp making machine, A. Sheldon ... 517,149
Pavements, method of and apparatus for repairing asphalt, A. H. Perkins ... 517,191
Phonograph, H. L. Sanborn ... 517,072
Photographic background holder, C. O. Johnson ... 517,119
Photographic camera shutter, W. L. Lightford ... 517,164
Photographic gallery skylight, W. Shaw *et al.* ... 517,364
Piano, zither, A. Marberger ... 517,285
Pianos, music desk for upright, J. P. Richardson ... 517,239
Picker. See Fruit picker.
Picture hanger, adjustable, M. Schwartz ... 517,195
Pipe. See Tobacco pipe.
Pitman head, P. Swenson ... 517,177
Planer, felly, W. R. Dunn ... 517,334
Planter, corn, B. F. Smith ... 517,245
Platform, step, A. G. Leonard ... 517,282
Plow, J. T. & J. A. Drummond ... 517,333
Plow, J. S. Edge ... 517,215
Plow, steam, C. F. Johnson ... 517,047
Post. See Fence post.
Precious metal, ornamenting and etching, H. Goodwin ... 517,275
Preserving vegetables, G. Dupont-Dennis ... 517,267
Press. See Toggle press.
Printing machine, platen, Harrild & Buckland ... 517,040
Propeller, screw, A. W. Case ... 517,025
Propeller, screw, F. Otte ... 517,233
Pruning implement, J. L. Joyce ... 517,385
Pulverizer, A. Fiscus ... 517,138
Pulverizing machine, W. M. Fuller ... 517,581
Pump, compression or exhaust, H. A. Fleuss ... 517,337
Pumping apparatus, W. B. Nevill ... 517,229
Punch, stamping, Saltzkorn & Nicolai ... 517,171
Punch, ticket, G. F. Matteson ... 517,053
Rack. See Jar rack.
Radiator, oil, H. Ruppel ... 517,242
Rail clamping or fastening device, M. A. Possons ... 517,236
Railway cross tie, Temple & Ward ... 517,369
Railway crossing danger signal, Eyer & Smeltzer ... 517,097
Railway, electrical, B. Bidwell ... 517,258
Railway flag signal, automatic, D. M. Bailey ... 517,111
Railway rail and chair and uniting same, M. M. Suppes ... 517,075
Railway switch, H. Elliot ... 517,379
Railway switch, J. C. Wolverton ... 517,090
Railway switch and signal apparatus, Norton & Devine ... 517,392
Railway terminal transfer and switch yard, J. D. Millar ... 517,110
Railway tie, metal, A. E. Roberts ... 517,302
Railway track structure, P. Heyner ... 517,277
Railway trolley, electric, F. S. Church ... 517,028
Rake. See Hay rake.
Refrigerating machine, L. Block ... 517,154
Registering mechanism, C. P. Gott ... 517,115
Revolvers, swinging cylinder and trigger lockfor, D. B. Wesson ... 517,152
Ring gauge, W. F. Doll ... 517,096
Riveting machine, Saltzkorn & Nicolai ... 517,172
Roasting coffee, cocoa, etc., apparatus for, C. A. Otto ... 517,189
Rod mill floor, G. Lehberger ... 517,224
Rolling mill, taper, C. B. Andrews ... 517,322
Safe, C. E. Clark ... 517,261
Sail for vessels, T. W. Ratsey ... 517,193
Sand distributer, H. Moorhouse ... 517,055
Sash securing device, A. Little ... 517,226
Screen. See Window screen.
Secondary battery, G. L. Ballard ... 517,018
Separator. See Centrifugal separator.
Sewing machine, D. Brown ... 517,376
Sewing machine, J. C. Goodwin ... 517,141
Sewing machine, buttonhole, W. V. Miller ... 517,354
Sewing machine trimmer, J. C. Goodwin ... 517,140
Shears, H. T. Seymour ... 517,244
Sheet metal cans, manufacturing, J. Lee ... 517,223
Sheet metal spinning, machinery for, F. Haberman ... 517,382
Sheet shackle, F. Robinson ... 517,068
Shelf, metallic, C. W. Marquardt ... 517,349
Shoe nailing machine, E. D. Childs ... 517,027
Show case, W. G. Irwin ... 517,342
Sieve, ash, J. Goldman ... 517,139
Signal. See Railway crossing danger signal. Railway flag signal.
Signals, electrical apparatus for controlling, M. B. Leonard ... 517,419
Sleigh knee socket, B. F. Sweet ... 517,076
Smoke and spark arrester, E. R. Jones ... 517,220
Smoke, apparatus for removing impurities from, E. v. Reiss ... 517,297
Smoke consumer, G. Rhoden ... 517,238
Smoke consuming furnace, S. T. Armstrong ... 517,324
Soap pressing and stamping machine, D. C. Ralston ... 517,064
Spindle bearing, J. H. Northrop ... 517,232
Spinning mule safety attachment, E. G. Varney ... 517,314
Spinning spindles, device for adjusting bearings of, G. O. Draper ... 517,270
Spring. See Elliptical spring.
Stair rod, A. Jones ... 517,279
Stamp attaching device, J. G. Pulling ... 517,295
Stamp canceling and postmarking letters, machine for, M. J. Dolphin ... 517,037
Steam boiler, G. F. Nilsson ... 517,147
Steam boiler, water tube, M. H. C. Shann ... 517,174
Steamer, fruit or vegetable, M. Fuller ... 517,217
Stool and cane, camp, M. R. Mathewson ... 517,351
Store fixture bracket, R. P. Palmenberg ... 517,190
Straw stacker, pneumatic, J. W. Nethery ... 517,290
Stump extra tor, G. B. Pulley ... 517,362
Switch. See Electric switch. Railway switch. Telephone switch.
Tablet forming machine, J. Beddow ... 517,153
Tanning, process of and apparatus for, C. B. Warrand ... 517,083
Telephone switch, F. R. Colvin ... 517,263
Telephone system, single-line, Sabin & Hampton ... 517,243
Tension device, H. Hibbert *et al.* ... 517,043
Testing machine clamp, C. C. Miller ... 517,356
Thermocauter, H. Wilson ... 517,180
Thermometer, E. A. Linder ... 517,388
Tile and constructing same, illuminating, P. M. Bruner ... 517,156
Tile placing device, T. C. Cook ... 517,329
Tire, C. Kehr ... 517,417, 517,418
Tire, pneumatic, C. L. Ames ... 517,414
Tire, pneumatic, Tollner & Potter ... 517,312
Tire protector, pneumatic, A. S. Davy ... 517,085
Tire, wheel, C. L. Ames ... 517,415
Tire, wheel, C. Kehr ... 517,416
Tires to wheel rims, means for securing pneumatic, P. Davies ... 517,113
Tobacco pipe, E. G. Delce ... 517,332
Toggle press, W. E. Brock ... 517,092
Tongues and grooves in ends of flooring boards, machine for forming interfitting, J. P. Burnham ... 517,326
Tonguing and grooving ends of flooring boards, machine for, J. P. Burnham ... 517,327
Tool holder, F. A. Pratt ... 517,167
Torpedo launching tube, Lloyd & Hutchinson ... 517,390
Transom opener, J. E. Anger ... 517,135
Traveling bag, G. Willringhaus ... 517,181, 517,182
Tricycle, F. Bena ... 517,019
Trimmer. See Sewing machine trimmer.
Trolley catcher, L. G. Mowry ... 517,166
Trough. See Hog trough.
Truck, E. Hickman ... 517,219
Truck, house moving, S. C. Maple ... 517,052
Truss, C. B. Rostel ... 517,194
Tug, hame, H. Bockelman ... 517,260
Turnstile, S. P. Walmsley ... 517,080
Turntable, Pratt & Brunner ... 517,126
Turntable, G. Rohrbach ... 517,304
Turret mechanism, F. H. Richards ... 517,168
Twisting machine stop motion, H. & J. W. Collins ... 517,030
Typesetting apparatus, L. K. Johnson ... 517,144
Typewriter cabinet, S. L. Conde ... 517,031
Valve, J. A. Cattanach ... 517,093
Valve, D. McCormack ... 517,056
Valve, J. E. Stannard ... 517,199
Valve, air, D. R. Berry ... 517,184
Vapor burner, J. A. Lannert *et al.* ... 517,048
Vehicle wheel, W. W. Valentine ... 517,201
Vessel, sailing, J. M. Boorman ... 517,155
Vessels, self-regulating discharge for closed, A. H. & T. A. Schlueter ... 517,305
Vise, J. M. Lewis ... 517,347
Washboard, G. B. Lutomski ... 517,187
Washing machine, Z. M. Lindley ... 517,225
Washing machine, H. R. Ward ... 517,081
Watchman's shot-proof box, S. E. White ... 517,086
Wheel. See Vehicle wheel.
Whirligig, W. J. McCarthy ... 517,228
Windmill, W. A. Blank ... 517,374
Windmill, G. B. Snow ... 517,198
Window frame, stained glass, H. A. Lewie ... 517,049
Window screen and attachment, C. H. Bartlett, Jr. ... 517,183
Wire cloth holder, W. Lasar ... 517,408
Wire netting machine, G. M. Wright ... 517,204
Wrench, O. C. Stanley ... 517,074
Wrench, combination, H. A. Post ... 517,393
Wringer. See Mop wringer.

DESIGNS.

Bicycle clip holding block, G. E. Curtis ... 23,160
Brushes, etc., back for, C. Graff ... 23,151
Carpet fastener, stair, J. Day ... 23,158, 23,159
Coin receiver case, C. C. Clawson ... 23,154, 23,155
Dish, cover, C. E. Haviland ... 23,149
Electrical instruments, supporting frame for, E. Weston ... 23,156, 23,157
Picture frame moulding, A. H. Durbur ... 23,152, 23,153
Stove or range, cooking, Magee & Osborne ... 23,162
Stovepipe section, J. Spear ... 23,161
Toothpicks, etc., holder for, J. Ludwig ... 23,150

TRADE MARKS.

Baking powder, C. T. Long ... 24,423
Bed springs, Smith & Davis Manufacturing Company ... 24,431
Canned fish, fruit, and vegetables, Moos & Company ... 24,424
Chemical and pharmaceutical preparations, Actien-Gesellschaft fur Anilin-Fabrikation ... 24,418
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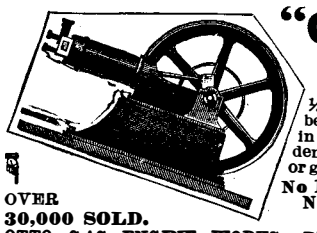
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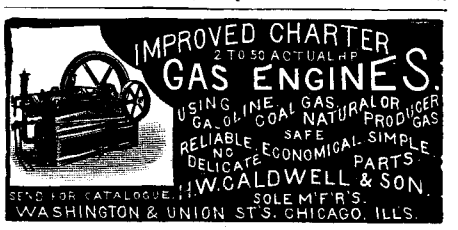

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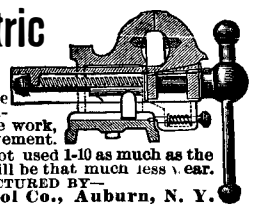
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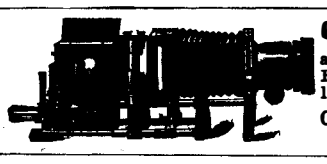
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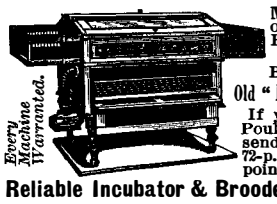

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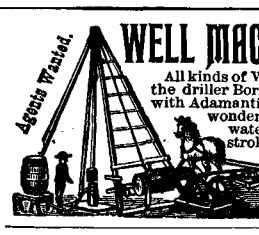

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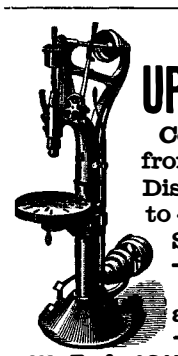
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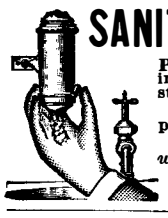

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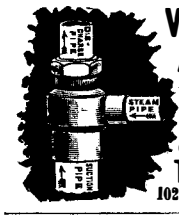

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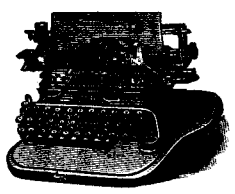

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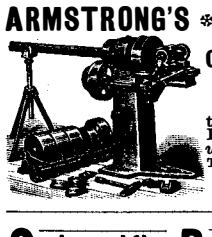

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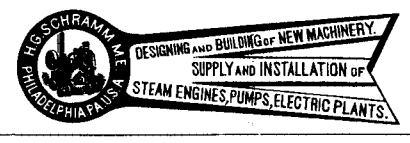

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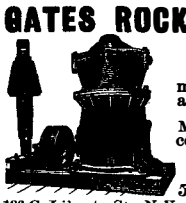

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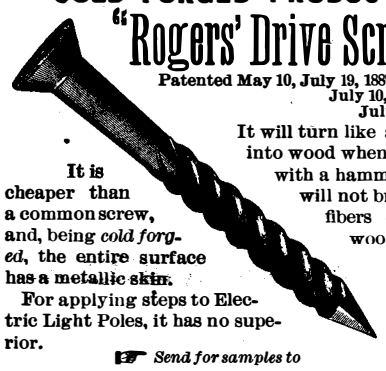

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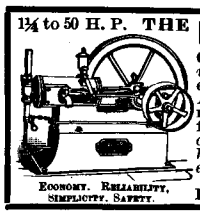

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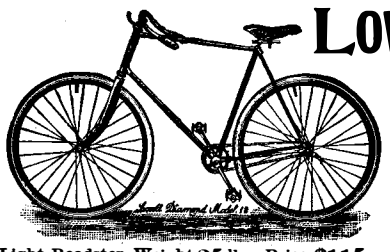

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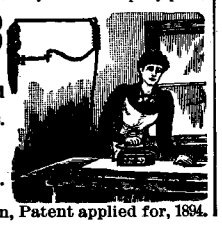

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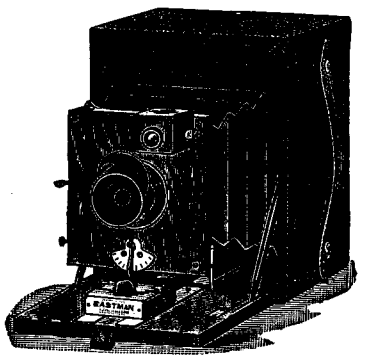

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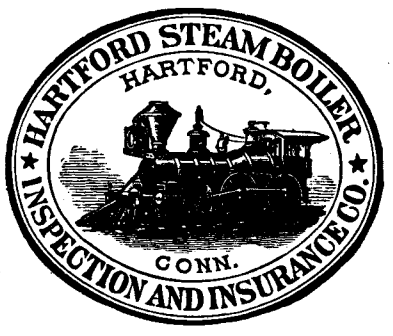

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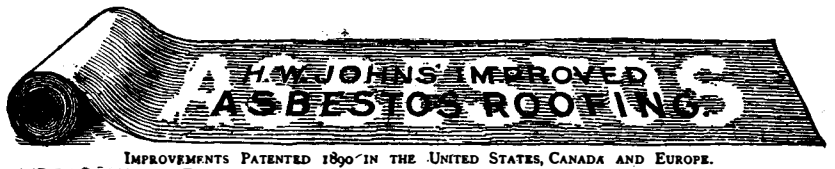

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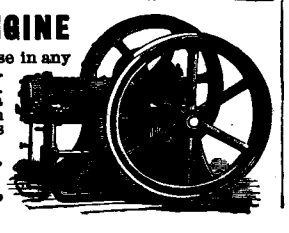

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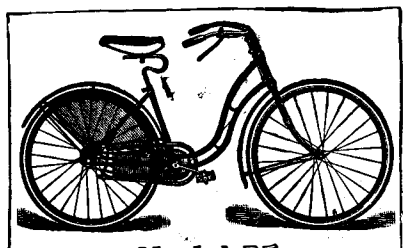

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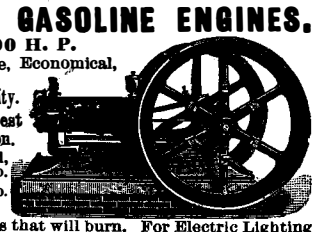

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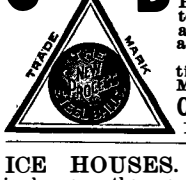

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